TR-2299

AD-A135 029

DAVIDSON LABORATORY

Technical Report SIT-DL-82-9-2299

November 1982

TESTS OF TOWED ARRAYS OF AIR CUSHION AMPHIBIOUS VEHICLES IN CALM WATER AND WAVES

by

G. Fridsma and W.E. Klosinski

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER SIT-DL-82-9-2299	2. GOVT ACCESSION NO. AD-A135 029 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) TESTS OF TOWED ARRAYS OF AIR CUSHION AMPHIBIOUS VEHICLES IN CALM WATER AND WAVES	5. TYPE OF REPORT & PERIOD COVERED FINAL July - November 1982
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) G. Fridsma and W.E. Klosinski	8. CONTRACT OR GRANT NUMBER(s) N00167-82-K-0114
9. PERFORMING ORGANIZATION NAME AND ADDRESS DAVIDSON LABORATORY Stevens Institute of Technology Castle Point Station, Hoboken, NJ 07030	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER Bethesda, MD 20084	12. REPORT DATE November 1982
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) U.S. MARINE CORPS PROGRAM OFFICE, CODE 112 Department of the Navy Bethesda, MD 20084	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

AMPHIBIOUS TRACKED VEHICLES
AIR CUSHION VEHICLES
COUPLED VEHICLES
AMPHIBIANS
VEHICLE TRAINS

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Amphibious tracked vehicles, supported by air cushions, were towed in trains up to 4 units in calm water and waves. The ACV unrestrained arrays were tested as though being towed by a helicopter or by an LCAC, up to speeds of 45 mph. Additional parameters included intervehicle spacing and track position. The towing force was found to be primarily a function of speed, number of units, and intervehicle spacing. Acceleration and pressure fluctuations were independent of configuration.

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S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Prepared for
DAVID W. TAYLOR
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER
CODE 112
under
Contract N00167-82-K-0114
(Davidson Laboratory Project 5047/219)

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INTRODUCTION

A series of investigations into the hydrodynamic and vehicle mobility characteristics of tracked amphibious vehicles is being carried out by the Davidson Laboratory in support of the Marine Corps Surface Mobility Exploratory Development Plan. These investigations have been initiated under the direction of the David W. Taylor Naval Ship Research and Development Center (NSRDC), Code 112 which manages the Mobility Program. A bibliography of the results achieved in previous investigations is reported herein.

The present tests undertake to provide basic technology contributing to the development and implementation of improvements in the surface mobility of amphibious vehicles by supporting them on an air cushion and coupling them together in a towed array. Measurements of the towing force (drag) and seakeeping characteristics in Sea State 2 were the primary objectives.

Supporting an amphibious tracked vehicle on an air cushion has some advantages over the conventional vehicle because the bow burying and deck wetness problems are eliminated. The total effective drag of the air cushion vehicle (ACV), which may be expected to be of the same order as that of the conventional displacement hull at speeds up to 15 mph, is significantly reduced at higher speeds. Consequently the towing force, which does not include fan drag, is expected to be lower over the speed range up to 45 mph. The propulsion of an ACV amphibian presents serious problems however, since air propulsion is out of the question and water propulsion requires retractable drive-shafts passing through the support bubble. In order to realize the potential benefits of ACV support while avoiding the propulsion problem, Code 112 suggested that the ACV amphibian should be towed rather than be self-propelled. This "tug and barge" concept led to the concept of a vehicle train which would reduce the unit vehicle drag. Candidates considered for the role of towing the train of ACV's included a helicopter and an air-cushion landing craft (LCAC).

In addition to speed and type of tow, other parameters investigated included number of vehicles in the train (up to four), inter-vehicle spacing, and track position, whether retracted or extended.

Tests were carried out in the Tank 3 facility of the Davidson Laboratory during the period 9 to 22 September 1982. Mr. Walter Zeitfuss, Jr. (NSRDC, Code 112) and Mr. Nic Economou (Bell Aerospace, Textron) were present for part of the tests to monitor the behavior of the ACV's and to offer technical assistance.

MODELS

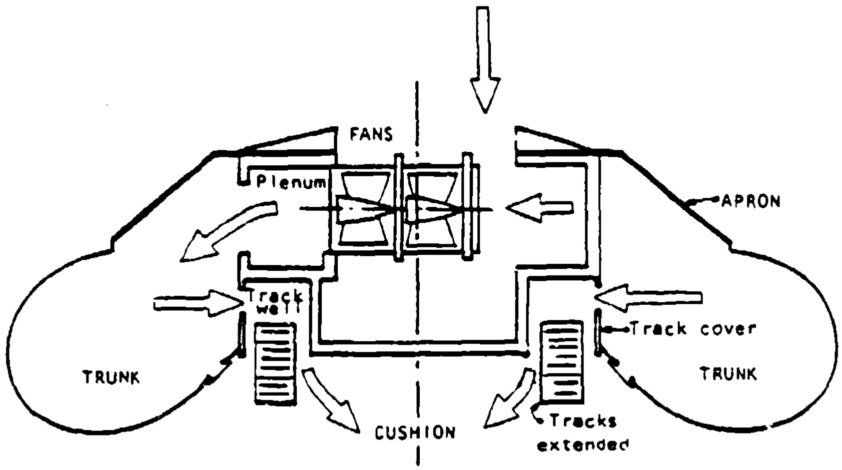
Four identical 1/8 scale test models of the ACV were fabricated at the Davidson Laboratory according to drawings supplied by Bell Aerospace (Buffalo) and NSRDC. The configuration consisted of a hull very similar to the small amphibian "FLASH" (Reference 2) supplemented by an inflatable trunk to retain the air cushion. Views of one of the complete ACV models are included on Figures 1 and 2.

Lucite was used in the construction of the hull, neoprene impregnated cloth was used for the trunk, and aluminum was used for the trunk support (apron) and other fastenings. The photograph on Figure 3 shows the model's constituent parts.

In order to make the trunk, a wooden mold was constructed which included the shape of the trunk itself and those parts of the apron and hull to which the trunk would be attached. The 0.008 inch thick neoprene cloth was applied on the mold, cut and seamed, and then fitted to the attachment points. The mold as constructed to the drawings supplied by Bell, however, failed to produce a smooth rounded trunk that was tangent to the ground plane. Modifications to the mold were necessary to achieve this smoothness, particularly in the four corners where the various segments of cloth joined. After some trial and error, a good fit was obtained and four trunks were constructed. Excess material was provided at the attachment points for final fitting to the model with the trunk inflated. The resulting trunk achieved a good tangent plane when placed on a carpeted surface table. Final assembly included the gluing and sewing of surgical tape over the seams, inside and out, for additional reinforcement of these joints.

A lucite fan-housing box was built inside the model and attached to the starboard side of each model, just above the tracks. Holes for two fans were cut in this housing which supported two sets of stacked fans, for a total of four Aximax 3 fans in each model. Air through these holes

supplied the trunk, whose upper half was attached to the hull at the apron and whose lower half was attached to the bottom of the track covers and the hull at the bow and stern. The following sketch shows the air supply to the trunk and cushion.



Provision for adjusting the trunk pressure was made by a hole, cut in the apron, on the stern centerline to vent air from the trunk to atmosphere. To supply air from the trunk to the cushion, the original design called for holes to be cut in the trunk fabric, as indicated in the sketch. Because of the possibility of water getting into the trunk, Davidson Laboratory recommended that the cushion feed holes be sealed and holes in the track covers be provided. This modification to the design was discussed with Bell Aerospace and thought to be an improvement in the design. As a result eighteen 6 inch diameter holes (full scale) were drilled to provide the inlet area specified by Bell for air from the trunk to the cushion, 6 in each of the port and starboard track covers and 6 at the bow. Here and hereafter all quantities are given in full scale terms. The holes were positioned longitudinally in the track covers at the approximate locations specified in the Bell drawings. Some minor adjustment was necessary in order for the air to be supplied between the road wheels, otherwise the airflow would be throttled by the wheels when the tracks were retracted.

To duct air through the bow structure, from the trunk to the cushion, an enclosed compartment was built inside the lower hull which straddled the lower trunk attachment point on the bow. The upper half of this compartment had a 280 square inch slotted hole milled in it which opened into the trunk. The lower half had six 6 inch diameter holes drilled in it which opened into the cushion.

During the fan calibration tests, it was found that the design pressure drop between the trunk and cushion could not be achieved with the specified holes. Consequently the holes in the track covers were enlarged to 8 inch diameter, which provided the proper pressure drop. The total inlet area to the cushion became 5.36 square feet, full size.

The track-suspension system, road wheels and tracks, were attached to a horizontal plate which could be mounted to the hull to simulate either the fully extended or retracted track positions. Photographs showing the cushion air-supply inlet area and the suspension system are shown on Figure 4.

Two pressure taps were mounted in the model. The trunk pressure tap was located on the port side, 15 inches forward of the transom and 39 inches above the hull bottom. The cushion pressure tap was located in the hull bottom on the craft centerline, 35 inches forward of the transom. These can be seen in the top photo of Figure 4.

The models were ballasted to a 30,000 lb displacement, with a VCG 28 inches above the hull bottom, and an LCG 110 inches aft of the bow hard structure. Other ACV particulars can be found in the table following the text of this report.

During on-cushion check out tests on a surface table, a vibration was observed in the forward trunk region. A narrow aluminum "finger" curved in the shape of the trunk was fastened to the apron at the bow and effectively suppressed the oscillation (see Figures 1 and 2). It was demonstrated by Mr. Economou that the same effect could be achieved by adding a small weight to the trunk at the bow.

Fan Calibration

An overall calibration of the fan system was requested by Bell Aerospace. The fans were calibrated, while they were mounted in a model, by the use of a specially constructed calibration box (see Figure 6). This air tight box was fabricated from 1/2 inch plywood and consisted of a large upper compartment into which the test model was placed and a smaller lower compartment, which served as an extension of the cushion plenum. The lower plenum was equipped with a pressure tap and various sized orifices through which the air discharged into the atmosphere. To provide an air-tight seal between the model and upper compartment, neoprene impregnated material was fastened between the metal apron of the model and the external periphery of the upper compartment. This ensured that all of the air flow exited either through the holes in the lower compartment, or through the trunk pressure adjustment orifice located in the aft end of the model apron.

The pressure-flow relationship for the trunk and cushion could be controlled by either changing the hole diameter in the vertical track covers or by varying the area of the trunk vent in the stern apron

After spending some time calibrating the system and experimenting with the variables, a combination was obtained which produced a pressure-flow curve very similar to the prototype requirement (see Figure 7). The trunk to cushion area was 5.37 square feet and the trunk vent area was 1.79 square feet. The experimental design point (full size) was 119 psf for the trunk pressure and 72 psf for the cushion at a flow rate of 610 cfs.

MODEL TEST PROCEDURES

A ground board was constructed inside the dock end of Tank 3, just above the still water surface, for the purpose of stowing the models when off cushion prior to and after the end of each test run. This was necessary because a back flow of water through the cushion air-supply holes when the fans were off could cause the trunks to fill with water and the model to sink. The test procedure was as follows. With the models resting on the ground board and the fans off, zeroes were taken. The fans were then turned on, and the models were slowly towed off the board and into the water to the starting position of the run. At the end of the

run, the models were towed back to the dock and up onto the ground board, where the fans were shut off.

The ACV models were towed by lines, simulating a tow by either a helicopter or an LCAC, singly or in a train of up to four vehicles. The helicopter tow consisted of a single line 100 feet long attached on the lead craft centerline at the bow and angled upwards at 10 degrees. The LCAC tow consisted of a V-shaped bridle attached 18 1/2 feet apart at the LCAC and on the bow centerline of the lead ACV. This tow line was 30 feet long with a 7 degree upward slope. The tow lines between the ACV's were all V-shaped bridles attached on the bow centerline and spread 8 feet across at the stern of the ahead ACV. The lengths of the towing bridles were adjusted to achieve three spacings between the ACV's resulting in hard hull structure spacings of 42.7 feet, 22.7 feet and 13.3 feet and trunk to trunk spacings (minimum distances between ACV's) of 30.7 feet, 10.7 feet and 1.3 feet respectively. Nylon cord was used for all model tow lines (rather than stainless steel wire) in order to simulate a degree of stiffness somewhat representative of the prototype lines. The lines were fitted at the ends with heavy-duty swivels and snap-hooks for quick attachment to the eye bolts in the models.

APPARATUS AND INSTRUMENTATION

The train of ACV LVT's was to be towed by either a helicopter or an LCAC. The towing vehicle was simulated by a spreader bar attached to a drag balance for measuring the horizontal component of the tow line tension. The spreader bar was equipped with three eye bolts located symmetrically under the balance, one on the centerline for the helicopter tow, and two outboard for the LCAC tow.

Since the models were towed by flexible lines, they had all six degrees of freedom. No yaw restraint was employed to allow for observations of the tracking stability.

The trunk and cushion pressures in each model were measured in the calm water tests as well as the drag or towing force. In Sea State 2 additional measurements were taken of the vertical accelerations in each ACV at the driver's station, and the vertical and horizontal accelerations in the troop compartment. The vertical units were located, respectively, 4.7 and 13.8 feet aft of the bow hard structure. A wave strut was used to

monitor the waves and to record encounters.

The signals from the transducers were relayed by overhead cable to the data station on shore, where they were filtered (40 Hz low pass) and processed by an on-line PDP-8e computer, which includes an analog to digital converter. The rough water data, which were scanned at 250 Hz, were stored on the computer's disks. For the four-unit train, twenty-two channels of data were measured and recorded. Test run data were monitored on a direct writing oscillograph.

Photography

Video tape recordings were made of ach run by a television camera mounted ahead and to port of the lead model. Selected above-water color still photographs were taken of the models in calm water and in waves, see Figure 5.

Wavemaker

The newly installed Davidson Laboratory Tank 3 wavemaker was used for these tests. This is an articulated double flap wet-back wavemaker, consisting of upper and lower flaps each powered by a hydraulic cylinder. A PDP 11/23 computer generates the signals for controlling the movement of the hydraulic actuator-flap system and, therefore, the size and shape of the waves. For the present tests, a wave train, having a variance density approximating the Pierson-Moskowitz spectrum with a 2.2 foot significant wave height, was used corresponding to Sea State 2 (see Figure 17).

DATA REDUCTION

Calibrations of the instrumentation were made by applying known loads to the force balance, gravity multiples to the accelerometers, and known pressures to the pressure transducers. During calibration, the outputs from the transducers were relayed to the PDP-8e computer. All calibrations were linear, and straight lines were fitted to these data by the least squares technique.

Test results were determined from the differences between transducer outputs in the running and static, off-cushion conditions. Velocities were computed from the time taken to travel through the data trap, which

was 50 feet for the calm water tests and 150 feet for the wave tests.

Processing of the calm water data produced mean values for the drag, and for the trunk and cushion pressures in each ACV. For the wave tests, a peak-trough analysis was performed on the drag, the trunk and cushion pressures, the troop and driver vertical accelerations, and the horizontal acceleration in each ACV. A peak-trough analysis of each signal resulted in the mean and rms, the number of oscillations, the average of the peaks and troughs, the average of the 1/3 highest and the 1/10 highest peaks and troughs, and the extreme values of the peaks and troughs. Buffers were used to suppress small oscillations associated with noise rather than the substantive time histories.

Repeat runs were made in different portions of the irregular wave train, at speeds above 15 mph, to get adequate samples of data for statistical analysis.

In addition to the above data processing, air flow and fan drag were computed for all tests. The following equations were used:

$$\text{Cushion Flow} = 95 * \text{SQRT}\ (PT - PC)$$

$$\text{Fan Drag} = (PT \times \text{Flow})/V$$

where: PT = Trunk Pressure, psf
PC = Cushion Pressure, psf
V = Forward Speed, fps

Mean values of pressure were used for these computations in the wave tests.

RESULTS

The results of the tests in calm water and waves are presented in Tables 1 to 9. Each table is labeled as to the number of units in the train, the type of tow, the spacing between vehicles, and the position of the tracks. The calm water data (Tables 1-6) have been sorted by values of increasing speed for each of the six configurations tested. The model quantities have been expanded to full size by the following ratios

Ship Drag = 526 * Model Drag

Ship Pressure = 8 * Model Pressure

Ship Flow = 181 * Model Flow

Ship Fan Drag = 512 * Model Fan Drag

where: 1.027 SR ** 3 = 526

SR = 8

SR ** 2.5 = 181

SR ** 3 = 512

SR = Scale Ratio

1.027 = Water Density Ratio between salt and fresh water.

The fan drag is included because it is useful in determining the efficiency of the vehicle in terms of the lift/drag ratio. The fan drag is simply a conversion of the fan horsepower into an "equivalent" drag. The decrease in hydro-drag must be offset by the fan drag in order to account for the energy being expended to sustain the air cushion beneath the vehicle. To obtain the true lift/drag ratio the "total" drag can be divided into the weight. Thus in Table 1 for speeds of 10, 20 and 30 mph, the lift/drag ratios are respectively 2.9, 4.9 and 5.7.

Spacing in this report refers to the inter-vehicle spacing between the hard structure, i.e. between the bow and stern of the hull in the absence of the apron and trunk.

The data for the rough water tests are included in Tables 7 to 9, each table applying to a particular length for the ACV train. Each page presents the full scale values for a given set of test conditions such as speed, weight, LCG, and sea state. The mean drag or horizontal component of the towing force and the number of wave encounters are displayed at the top of the page along with a statistical analysis of the drag variations. Normally drag statistics are not presented because of the frequency response of the drag balance. For the tests reported herein, the elastic nylon cord tow line determines the frequency response. The model nylon tow line had a stiffness corresponding to 1,600 lb/in full size.

The rest of the page in Tables 7 through 9 presents, for each vehicle in the train, the statistics of the driver and troop acceleration, the horizontal acceleration, and the cushion and trunk pressures. The statistics include the mean and RMS values and the average, the average of the 1/3 highest, the average of the 1/10 highest, and the extreme values of the peaks and troughs. Blanks in the table of statistics generally indicate that the sample size was too small (a minimum of 5 oscillations must be observed to record a statistic).

The calm water performance of the ACV train is plotted on Figures 8 to 16. The performance in Sea State 2 is presented on Figures 18 to 25.

A video tape recording of all runs has been sent to NSRDC, Code 112, together with still photographs of selected runs. A scenario for the video tape is contained in the Appendix.

DISCUSSION

The pressure-flow requirements specified by Bell for the ACV are shown on Figure 7 along with the actual model fan calibrations. The calibrations match the specification at the design point, and the slopes of the pressure-flow curves for the trunk and cushion are in reasonable agreement with those specified. Under operating conditions, at speeds above 20 mph, the trunk and cushion pressures were 119 and 78 psf respectively at a cushion flow of 608 cfs. These are the precise design requirements for the ACV. They were achieved, however, with a 52 percent increase in the design cushion inlet area of 3.53 square feet. The discharge coefficient for the model was determined from these numbers and was equal to 0.61, the value expected from a ninety degree sharp-edged orifice. Pressure-flow measurements at the hover condition produced consistent readings of 110 and 65 psf for the trunk and cushion pressures respectively and 637 cfs for the cushion air flow.

Before discussing the specific performance characteristics, some comments about the general behavior of the ACV train are offered. These comments relate to the two-unit train in calm water over a range of speeds, and are based on observations made during the test trials. In general they also apply to three and four unit trains.

Speed is the predominate parameter affecting the ACV's behavior in calm water. At 5 mph the ACV's ride at a level trim much like the hover condition. Spray is thrown forward as well as out from the model all around the periphery of the trunk. In general tracking (the ability of the trailing vehicles to align themselves behind the lead vehicle) was poor at this speed. Tracking, however, improves with speed and decreased spacing. At 7.5 mph an unusual "tuck under" oscillation occurs at the forward end of the trunk on the lead ACV. It appears as though suction forces due to the flow under the trunk create a bow down moment forcing the trunk into the water. The trunk is then seen to suddenly "pop up", possibly when the suction is overcome by the increased buoyancy. This cycle is repeated as the models proceed down the tank. The following units, riding in the wake of the lead ACV, do not exhibit this phenomenon. Spray continues to be thrown out around the trunk periphery but diminishes with increasing speed. Tracking is noticeably improved. At 10 and 11 mph, the ACV is operating just below or at the hump speed. A lot of water is seen to pile up against the front of the trunk. The "tuck under" phenomenon has disappeared, but the second unit of the train is still prone to wander a bit. As the speed is increased to 12.5 mph, the wave generated at the bow gets smaller and the second ACV of the train rides at a high trim angle. At 15 mph a small bow wave is still present and tracking is improved. Between 20 and 45 mph, the bow wave disappears, spray is generally deflected aft, and the models run cleanly. The higher the speed of the ACV, the better its behavior in terms of spray and tracking. In general the helicopter towed train tracked less well than the LCAC towed train, probably because of the single line tow as compared to a bridle tow.

In addition to speed, the spacing between vehicles has a significant effect on performance. Trains with the shortest spacing (13.3 ft) tracked better than trains with the longer spacings (22.7 and 43.8 ft). There was a considerable amount of spray generated between vehicles, however, at the 13.3 ft spacing. This can be attributed to the fact that with the trunks close together, the air flowing under the trunk trailing edge of the lead vehicle interacts with the spray generated at the bow of the following vehicle. Inter-vehicle spacing also has a dramatic effect on the drag characteristics particularly at the hump speed. Closer spacing reduces the hump drag.

While the effect of raising the track-suspension system level with the hull bottom did not effect the overall performance of the ACV's, it appeared that tracking deteriorated.

These qualitative comments are the result of observations or impressions obtained during the period of tank testing. The quantitive results are presented on Figures 8 to 25.

The calm water behavior of drag and pressure as a function of speed is shown in absolute terms for each of the six configurations in Figures 8 through 13. The drag curve has a destinctive characteristic that is very typical of ACV type craft (Reference 3). Starting from zero speed, the drag rises quickly to a rather sharply defined peak at the hump speed of 11 to 12 mph.

Above hump speed the drag falls dramatically and at 20 mph is approximately one half its maximum value. As speed increases beyond 20 mph, the drag rises moderately until the maximum test speed of 45 mph is reached. There does not appear to be an appreciable change in the hump speed with changing configuration. Also typical of ACV craft is the way the cushion pressure varies with speed. Starting from the hover condition the cushion pressure decreases slowly at first, then drops suddenly until a minimum is reached at the hump speed. This is followed by an abrupt recovery, however, when the cushion pressure rises with speed up to 20 mph. At the higher speeds the cushion pressure stays more or less constant. This characteristic applies to the single ACV and to the lead vehicle for the train configurations. Because of the inter-dependence between the trunk and cushion pressure for this particular ACV design, the trunk pressure's behavior parallels that of the cushion.

The pressure characteristics for the lead ACV are not necessarily those of the other units in the train. From Figures 8 to 13, it is clear that there is less fluctuation of the cushion and the trunk pressure with speed for the second and third units in the train than there is for the lead vehicle. Riding in the wake of an ACV therefore tends to smooth out the mean trunk and cushion pressures with speed.

Starting with Figure 14 some drag comparisons are made between the various configurations. The specific resistance or drag per ton of displacement is a useful quantity to plot versus speed. The drag is shown

to be independent of the type of tow for the 2 unit train (Figure 14). The drag reduction usually associated with coupled vehicles (on a specific basis) is not realized with the ACV trains. While some reduction is shown up to speeds of 25 mph, it does not compare with the order of magnitude experienced for the coupled LVT7 (Reference 1). THe reason for this is that the nominal spacing of the ACV units of 22.7 feet is on the order of 1 cushion length. This would be equivalent to spacing the LVT7's 1 boat length apart. It is not until the ACV's are brought closer together that any real drag reduction is realized. Figure 18 shows the 4 unit train in Sea State 2 for the nominal and shortest spacing. Here the effect of the closer spacing is to reduce the hump drag significantly (about 37 percent). Lengthening the inter-vehicle tow line for this two-unit train, to make the spacing about 2 cushion lengths, increases the hump drag and in general degrades the performance (Figure 15).

The effect of retracting the tracks level with the hull bottom is presented on Figure 15. There is little change in drag until above hump speed, and then there is a slight improvement over the limited speed range of 18 to 35 mph after which the drag with tracks up is greater than that with tracks down. Because of the poorer course keeping of the two unit train with the tracks retracted and the lack of drag reduction, together with the added complexity and weight associated with track retraction, the remaining configurations were tested with the tracks extended.

An analysis of the fan drag for all calm water configurations is presented on Figure 16. The height of the rectangles in the upper plot is an indication of the amount of variation between test conditions. The assumed linear decrease of fan horsepower with speed shown in the lower plot is consistent with the curve in the upper plot. This curve fits the data remarkably well, which confirms the assumed linear relation. Thus, as speed is increased, less horsepower is required to maintain the ACV cushion. This is consistent with the reduction in air flow with speed due to less leakage from the cushion.

In rough water, 3 configurations were tested, three and four unit trains with a spacing of 22.7 ft, and a four unit train with a 13.3 ft spacing. These results are presented in Figures 18 to 25.

Figures 18 and 19 present the drag results in Sea State 2. For the three-unit train, a drag comparison can be made between operations in calm water and Sea State 2. There is only a minimal increase in drag (8.5 percent at hump) at the low speed (Figure 18), from 20 to 35 mph, waves create a 20 to 35 percent increase in ACV resistance over that in calm water. It bears repeating that the drag reduction per ton of weight expected from running trains rather than single vehicles is not realized at the nominal spacings of 22.7 feet. It is when the vehicles are at their closest spacing that the specific drag is reduced significantly.

To design a tow line for the ACV train, the dynamic drag must be taken into account. The significant drag variations are plotted on Figure 19 where the maximum values are those of interest. It would appear that for three and four vehicle trains, a tow line able to take dynamic loads of 40,000 lb would be in order.

The rms and significant cushion and trunk pressure variations are included in Figures 20 and 21 respectively. The pressure fluctuations build up with increasing speed. The lead ACV experiences the largest pressure fluctuations. The fluctuations of the other three ACV's are almost identical. For speeds above 25 mph it is possible for the fluctuating cushion pressure to be zero or reach negative values. The significant maximum values over the same speed range are about double their mean values for vehicles 2, 3 and 4 in Sea State 2 and about triple their mean values for vehicle 1.

The acceleration data is presented on Figures 22 to 25 with trends similar to those for the pressures. The worst ride as measured by acceleration occurs near the bow where significant accelerations of 3 g's at 45 mph are experienced in the first and second units. These are gradually reduced to 1.5 g's as one proceeds along the train to the last unit. Accelerations in the lead ACV are comparable to those measured on the FSACV (Reference 3).

Figure 24 is presented to show that the accelerations experienced in a Sea State 2 are independent of spacing and the number of vehicles in the train. That is to say, the seakeeping results for the 4 unit train with shorter spacing are very similar to the results for the three and four vehicle train at the longer spacing, as typified by the behavior of the third unit in either train. An examination of the tabulated data

indicates that the drag, pressure and horizontal acceleration variations are also independent of vehicle spacing and number.

The horizontal accelerations depicted in Figure 25 are typical for all three configurations in Sea State 2 and are practically identical in all four units of the train. The significant values vary from ± 0.2 to ± 0.6 g's over the speed range from 5 to 45 mph. With positive accelerations being in the direction of motion, there does not appear to be a bias or preferred direction, fore and aft.

CONCLUDING REMARKS

Towing trains of amphibious tracked vehicles, supported by an air cushion, is a hydrodynamically viable alternative to the separately self-propelled amphibians currently employed for assault operations. The tow-line force (drag) is independent of how the trains are towed and is most affected by speed. Maximum drag occurs at the hump speeds between 11 and 12 mph, and the hump speed is not altered significantly with changes in either vehicle spacing or number. Close inter-vehicle spacing of the ACV's, together with increasing the number of vehicles in the train improves the specific resistance.

Seakeeping behavior is independent of the spacing and number of units in the train. The lead ACV experiences the worst ride with significant accelerations exceeding 2 and 3 g's over the speed range from 20 to 45 mph. Other units operating in the wake of the lead ACV have similar pressure variations, but progressively smaller accelerations toward the rear of the train. Excursions from the mean drag are also insensitive to spacing and number of units in the train.

Fan horsepower, required to maintain the cushion, decreases linearly with speed. When converted to a "equivalent drag" and added to the hydrodynamic drag, the total drag can be divided into the weight to obtain a lift/drag ratio. For the 4 unit train in Sea State 2 at the 13.3 ft spacing, overall lift/drag ratios of 3.9, 5.3 and 5.6 are obtained at 12.5 mph (hump speed), 20 mph and 30 mph respectively; this performance is comparable with that of a planing LVT.

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TABLE OF PARTICULARS

	Prototype	Model
Displacement, lb.	30,000	57.1
Length of ACV, in.		
Hard Structure	204	25.5
Overall Including Trunk	349	43.6
Beam of ACV, in.		
Hard Structure	106	13.25
Overall Including Trunk	242	30.25
Depth of ACV to Deck, in.		
Hard Structure	58.5	7.31
Overall Including Trunk	81.5	10.19
Center of Gravity, in.		
Aft of Bow Hard Structure	110	13.75
Above Hull Bottom	28	3.50
Hull Clearance Above Tangent Plane	23	2.88
Design Pressures, psf		
Trunk	117	14.6
Cushion	79	9.9

TABLE 1

TABLE 1

CALM WATER

SINGLE ACV, HELICOPTER TOW

TRACKS DOWN

RUN	SPEED MPH	DRAG LB	/ --------UNIT 1---------- / CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB
2	5.00	540.	62.	112.	671.	10260.
12	7.50	1950.	63.	115.	685.	7140.
3	10.00	5970.	58.	104.	639.	4510.
14	11.00	6500.	51.	104.	694.	4470.
13	12.51	5780.	61.	115.	699.	4400.
4	15.00	4510.	75.	122.	655.	3640.
5	20.01	3440.	76.	122.	645.	2670.
6	25.02	3040.	74.	122.	657.	2190.
7	29.71	3420.	75.	123.	656.	1830.
8	35.04	3320.	81.	122.	609.	1450.
15	40.04	3220.	78.	123.	639.	1340.
10	40.08	3690.	83.	123.	598.	1250.
11	45.10	3730.	71.	122.	676.	1250.

TABLE 2

TABLE 2

CALM WATER

TWO UNIT ACV TRAIN, HELICOPTER TOW

22.7 FT SPACING, TRACKS DOWN

			UNIT 1				UNIT 2			
RUN	SPEED MPH	DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB
16	5.00	870.	54.	112.	718.	10930.	64.	112.	659.	10040.
30	7.50	2700.	52.	119.	776.	8380.	68.	114.	643.	6660.
18	10.00	8520.	58.	104.	646.	4600.	67.	113.	646.	4970.
31	11.00	10380.	53.	100.	655.	4060.	74.	116.	620.	4470.
20	15.01	7870.	64.	118.	702.	3770.	77.	112.	562.	2860.
22	20.01	5940.	72.	123.	674.	2820.	70.	117.	653.	2610.
21	20.02	5800.	69.	121.	690.	2850.	71.			
23	25.03	6320.	78.	123.	635.	2120.	75.	115.	602.	1890.
24	30.02	6790.	77.	123.	642.	1800.	75.	114.	593.	1540.
25	35.04	7200.	76.	122.	649.	1540.	75.	118.	628.	1440.
27	40.08	7820.	79.	123.	629.	1320.	80.	118.	585.	1170.
29	45.10		70.				77.	119.	620.	1120.

TABLE 3

TABLE 3

CALM WATER

TWO UNIT ACV TRAIN, HELICOPTER TOW

42.7 FT SPACING, TRACKS DOWN

			--------UNIT 1				--------UNIT 2			
RUN	SPEED MPH	DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB
39	0.00		64.	113.	662.		64.	109.	635.	
32	5.00	830.	55.	121.	773.	12790.	66.	108.	617.	9060.
33	7.50	2850.	67.	125.	723.	8200.	76.	111.	564.	5710.
34	10.00	10050.	58.	114.	708.	5500.	72.	107.	559.	4070.
35	11.00	11980.	49.	112.	752.	5190.	72.	102.	517.	3270.
36	15.01	11220.	61.	117.	717.	3820.	75.	116.	612.	3230.
40	15.01	10990.	69.	117.	657.	3490.	72.	115.	623.	3240.
37	20.01	7190.	69.	125.	709.	3020.	78.	115.	575.	2250.
41	20.01	7090.	75.	123.	654.	2740.	72.	114.	613.	2390.
42	20.01	6890.	78.	124.	644.	2710.	77.	115.	590.	2320.
38	25.02	6160.	82.	122.	607.	2030.	80.	118.	586.	1880.
43	25.03	6120.	79.	125.	641.	2180.	79.	116.	580.	1830.
44	30.04	6580.	79.	122.	626.	1740.	75.	116.	613.	1620.
45	35.04	7420.	79.	123.	629.	1510.	79.	116.	575.	1300.
46	40.08	7440.	81.	123.	616.	1290.	81.	116.	561.	1110.
47	45.10		83.	123.	607.	1130.	75.	116.	611.	1070.

TABLE 4

TABLE 4

CALM WATER

TWO UNIT ACV TRAIN, LCAC TOW

22.7 FT SPACING, TRACKS DOWN

			UNIT 1				UNIT 2			
RUN	SPEED MPH	DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB
48	0.00		65.	113.	662.		65.	107.	619.	
49	7.50	3070.	57.	115.	719.	7500.	62.	113.	681.	7010.
50	10.00	8110.	58.	106.	652.	4690.		115.		6090.
51	11.00	10030.	52.	104.	680.	4370.	64.	115.	678.	4830.
52	12.51	10470.	63.	113.	676.	4180.	72.	115.	620.	3880.
53	15.01	8080.	72.	121.	661.	3630.	81.	120.	593.	3240.
54	20.01	6150.	80.	123.	625.	2630.	64.	114.	668.	2590.
55	30.04	7030.	81.	123.	614.	1720.	72.	114.	618.	1610.
57	40.08	7630.	82.	123.	608.	1270.	71.	114.	624.	1210.
56	45.10	8570.	79.	120.	611.	1110.	72.	114.	616.	1070.

TABLE 5

CALM WATER

THREE UNIT ACV TRAIN, LCAC TOW

22.7 FT SPACING, TRACKS DOWN

RUN	SPEED MPH	DRAG LB	UNIT 1 CUSH PRESS PSF	UNIT 1 TRUNK PRESS PSF	UNIT 1 FLOW CFS	UNIT 1 FAN DRAG LB	UNIT 2 CUSH PRESS PSF	UNIT 2 TRUNK PRESS PSF	UNIT 2 FLOW CFS	UNIT 2 FAN DRAG LB	UNIT 3 CUSH PRESS PSF	UNIT 3 TRUNK PRESS PSF	UNIT 3 FLOW CFS	UNIT 3 FAN DRAG LB
59	5.00	1190.	46.	107.	743.	10850.	62.				64.	111.	654.	9940.
60	7.50	3830.	55.	114.	731.	7590.	70.	112.	619.	6320.	69.	116.	654.	6910.
61	10.00	11130.	63.	102.	593.	4130.	73.	114.	605.	4690.	65.	115.	670.	5230.
69	11.00	13670.	55.	100.	635.	3930.	70.	118.	658.	4820.	71.	118.	654.	4800.
62	12.51	15840.	46.	110.	759.	4550.	73.	115.	615.	3860.	71.	118.	651.	4190.
70	13.5[illegible]	14950.	62.				75.	123.	652.	4040.	73.	121.	660.	4040.
64	15.01	11220.	71.	118.	650.	3490.	78.	120.	614.	3350.	76.	123.	653.	3640.
65	20.02	8840.	77.	125.	658.	2800.	70.	116.	641.	2520.	64.	118.	695.	2800.
66	30.02	9890.	78.	127.	667.	1930.	70.	115.	638.	1660.	65.	122.	721.	2000.
67	44.89	11780.	76.	123.	649.	1210.	74.	111.	580.	980.	74.	120.	640.	1160.

TABLE 6

TABLE 6

CALM WATER

TWO UNIT ACV TRAIN, LCAC TOW

22.7 FT SPACING, TRACKS UP

			---------UNIT 1				---------UNIT 2			
RUN	SPEED MPH	DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB	CUSH PRESS PSF	TRUNK PRESS PSF	FLOW CFS	FAN DRAG LB
72	7.50	2860.	63.	117.	696.	7390.	71.	118.	654.	7030.
73	10.00	8250.	66.	107.	611.	4460.	72.	119.	649.	5240.
74	11.00	10360.	51.	104.	688.	4430.	73.	120.	647.	4790.
75	12.50	10740.	67.	112.	641.	3930.	74.	119.	639.	4140.
76	15.01	7710.	78.	120.	612.	3340.	78.	123.	631.	3510.
77	20.01	5660.	85.	124.	590.	2490.	66.	114.	662.	2580.
78	30.04	6310.	87.	125.	583.	1650.	75.	115.	598.	1560.
81	35.04	7260.	89.	126.	578.	1410.	78.	116.	588.	1330.
80	40.04	8450.	80.	125.	642.	1370.	73.	107.	555.	1010.
79	45.06	9040.	84.	127.	619.	1190.	72.	111.	594.	1000.

DAVIDSON LABORATORY — 15-SEP-82

TABLE 7-1

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 86

SPEED	5.0 MPH	WAVE ENCOUNTERS	26
WEIGHT	30000. LB	SEA STATE	2
DRAG	1440. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	1.445	14	4.24			7.09
KIPS	1.251	3.42	-0.38			-1.19
-----LVT 1---------FLOW 660. CFS------FAN DRAG 10080. LB---------						
DRIVER ACC	0.007	26	0.44	0.57		0.70
G,#1	0.176	0.60	-0.41	-0.51		-0.58
TROOP ACC	-0.022	21	0.41	0.55		0.87
G,#1	0.150	0.60	-0.35	-0.41		-0.46
HOR ACC	-0.111	15	0.07	0.10		0.14
G,#1	0.082	0.25	-0.29	-0.34		-0.38
CUSH PRESS	62.981	6	85.38			91.32
PSF	6.279	32.00	45.53			42.98
TRUNK PRESS	111.610	5	145.32			154.37
PSF	9.429	48.00	87.45			84.06
-----LVT 2---------FLOW 650. CFS------FAN DRAG 9570. LB---------						
DRIVER ACC	-0.001	22	0.37	0.44		0.52
G,#2	0.164	0.60	-0.43	-0.54		-0.63
TROOP ACC	-0.012	26	0.39	0.46		0.57
G,#2	0.150	0.50	-0.32	-0.41		-0.62
HOR ACC	-0.064	15	0.10	0.14		0.17
G,#2	0.081	0.25	-0.26	-0.31		-0.38
CUSH PRESS	61.947	24	80.76	92.53		117.12
PSF	7.295	24.00	45.25	40.37		38.28
TRUNK PRESS	108.381	18	133.87	139.29		142.02
PSF	9.051	40.00	85.97	82.07		79.59

DAVIDSON LABORATORY

TABLE 7-1
ACV BARGE TRAIN
(Continued)

15-SEP-82

RUN 86

SPEED 5.0 MPH
WEIGHT 30000. LB
DRAG 1440. LB

WAVE ENCOUNTERS 26
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 630. CFS------FAN DRAG 9600. LB---------						
DRIVER ACC	-0.011	29	0.43	0.58		0.73
G,#3	0.184	0.60	-0.42	-0.52		-0.70
TROOP ACC	-0.005	40	0.35	0.45		0.58
G,#3	0.158	0.45	-0.31	-0.40		-0.50
HOR ACC	0.085	7	0.32			0.45
G,#3	0.078	0.35	-0.11			-0.17
CUSH PRESS	67.220	76	86.05	94.05	101.71	111.03
PSF	9.797	24.00	49.33	42.51	36.59	17.47
TRUNK PRESS	111.469	56	136.54	143.87	150.96	156.78
PSF	10.838	36.00	88.95	82.87	77.89	73.56

DAVIDSON LABORATORY TABLE 7-2 28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 87 , 112

SPEED	10.0 MPH		WAVE ENCOUNTERS	44
WEIGHT	30000. LB		SEA STATE	2
DRAG	12760. LB		LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	12.761	60	18.13	21.36	23.25	24.66
KIPS	3.700	3.42	7.49	5.33	4.12	2.90
-----LVT 1----------FLOW	616. CFS------FAN DRAG	4230. LB----------				
DRIVER ACC	0.001	11	0.42			0.51
G,#1	0.186	0.60	-0.41			-0.49
TROOF ACC	-0.008	6	0.44			0.61
G,#1	0.154	0.60	-0.36			-0.54
HOR ACC	-0.055	63	0.17	0.26	0.31	0.34
G,#1	0.132	0.25	-0.28	-0.40	-0.51	-0.60
CUSH PRESS	58.659	84	100.35	123.46	140.42	158.36
PSF	18.753	32.00	33.81	23.14	18.12	14.08
TRUNK PRESS	100.738	8	130.83			139.83
PSF	12.695	48.00	64.86			54.96
-----LVT 2----------FLOW	690. CFS------FAN DRAG	5220. LB----------				
DRIVER ACC	0.003	45	0.41	0.51		0.97
G,#2	0.195	0.60	-0.44	-0.57		-0.78
TROOF ACC	0.003	46	0.39	0.54		0.79
G,#2	0.182	0.50	-0.34	-0.44		-0.55
HOR ACC	-0.030	54	0.18	0.28	0.35	0.42
G,#2	0.124	0.25	-0.24	-0.34	-0.39	-0.44
CUSH PRESS	59.185	87	94.43	132.64	180.06	250.44
PSF	16.163	24.00	40.04	26.17	16.96	-5.20
TRUNK PRESS	111.457	38	136.01	143.95		14[illegible].88
PSF	11.032	40.00	84.29	77.73		74.13

DAVIDSON LABORATORY

28-OCT-82

TABLE 7-2

ACV BARGE TRAIN

(Continued)

RUN 87 , 112

SPEED 10.0 MPH
WEIGHT 30000. LB
DRAG 12760. LB

WAVE ENCOUNTERS 44
SEA STATE 2
LCG 110.0 IN

-----LVT 3----------FLOW 700. CFS------FAN DRAG 5620. LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	-0.020	61	0.42	0.53	0.62	0.68
G,#3	0.222	0.60	-0.46	-0.61	-0.72	-0.81
TROOP ACC	-0.007	52	0.43	0.58	0.70	0.86
G,#3	0.195	0.45	-0.32	-0.44	-0.54	-0.66
HOR ACC	0.036	36	0.32	0.44		0.60
G,#3	0.133	0.35	-0.22	-0.32		-0.45
CUSH PRESS	63.875	54	91.76	128.44	183.79	242.82
PSF	16.899	24.00	29.18	-2.99	-29.99	-34.85
TRUNK PRESS	117.940	67	142.75	150.46	156.32	162.19
PSF	13.031	36.00	92.03	83.39	76.66	67.27

DAVIDSON LABORATORY TABLE 7-3 28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 113, 88

SPEED 12.5 MPH
WEIGHT 30000. LB
DRAG 17210. LB

WAVE ENCOUNTERS 40
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	17.210	57	25.37	30.22	33.23	35.57
KIPS	6.063	3.42	9.85	6.43	3.71	0.71
-----LVT 1---------FLOW 746. CFS------FAN DRAG 4645. LB---------						
DRIVER ACC	-0.012	29	0.66	0.87		1.33
G,#1	0.287	1.00	-0.62	-0.73		-0.86
TROOP ACC	0.010	33	0.62	0.76		0.85
G,#1	0.296	0.90	-0.58	-0.73		-1.04
HOR ACC	-0.171	69	0.10	0.23	0.33	0.57
G,#1	0.177	0.25	-0.43	-0.56	-0.65	-0.67
CUSH PRESS	52.573	28	77.71	85.83		107.53
PSF	8.561	32.00	33.81	27.76		19.55
TRUNK PRESS	114.197	43	163.98	192.85		291.78
PSF	17.328	48.00	85.22	74.52		60.62
-----LVT 2---------FLOW 600. CFS------FAN DRAG 3670. LB---------						
DRIVER ACC	-0.004	38	0.45	0.58		0.76
G,#2	0.211	0.60	-0.45	-0.58		-0.68
TROOP ACC	0.002	49	0.43	0.57		0.72
G,#2	0.231	0.50	-0.41	-0.58		-0.91
HOR ACC	-0.063	53	0.23	0.35	0.48	0.66
G,#2	0.179	0.25	-0.35	-0.51	-0.63	-0.76
CUSH PRESS	73.732	40	98.58	110.30		117.94
PSF	7.986	24.00	63.43	49.83		32.26
TRUNK PRESS	112.999	39	138.87	147.46		156.33
PSF	13.209	40.00	83.84	75.56		65.27

DAVIDSON LABORATORY

28-OCT-82

TABLE 7-3

ACV BARGE TRAIN

(Continued)

RUN 113 , 88

SPEED 12.5 MPH
WEIGHT 30000. LB
DRAG 17210. LB

WAVE ENCOUNTERS 40
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 580. CFS------FAN DRAG 3660. LB---------						
DRIVER ACC	-0.023	42	0.44	0.63		0.88
G,#3	0.254	0.60	-0.54	-0.67		-0.87
TROOP ACC	-0.008	52	0.38	0.50	0.61	0.78
G,#3	0.210	0.45	-0.37	-0.50	-0.58	-0.70
HOR ACC	0.109	37	0.43	0.53		0.73
G,#3	0.151	0.35	-0.15	-0.26		-0.33
CUSH PRESS	76.795	26	78.57	91.76		103.04
PSF	14.366	24.00	34.85	19.82		3.79
TRUNK PRESS	114.679	52	142.10	152.06	159.32	163.68
PSF	14.709	36.00	87.10	78.35	73.12	65.03

DAVIDSON LABORATORY | TABLE 7-4 | 28-OCT-82

ACV BARGE TRAIN

THREE UNITS LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 89 , 114

SPEED	15.0 MPH		WAVE ENCOUNTERS	37
WEIGHT	30000. LB		SEA STATE	2
DRAG	13430. LB		LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	13.628	50	21.07	25.34	28.23	28.91
KIPS	5.620	3.42	6.44	2.66	0.96	-0.28
------LVT 1---------FLOW 560. CFS------FAN DRAG 3060. LB---------						
DRIVER ACC	-0.011	35	0.89	1.36		2.88
G,#1	0.387	1.00	-0.72	-0.90		-1.15
TROOF ACC	-0.006	44	0.69	0.89		1.19
G,#1	0.371	0.90	-0.64	-0.82		-1.13
HOR ACC	-0.153	61	0.17	0.37	0.49	0.64
G,#1	0.224	0.25	-0.47	-0.63	-0.77	-0.98
CUSH PRESS	85.564	66	114.74	131.33	152.50	189.64
PSF	16.703	32.00	55.42	40.13	28.60	17.60
TRUNK PRESS	120.363	73	173.79	211.47	251.97	307.13
PSF	23.542	48.00	83.53	60.52	47.79	35.56
-----LVT 2---------FLOW 670. CFS------FAN DRAG 3610. LB---------						
DRIVER ACC	0.005	52	0.66	0.91	1.18	1.54
G,#2	0.348	0.60	-0.53	-0.72	-0.79	-0.85
TROOF ACC	-0.001	55	0.53	0.77	0.90	0.95
G,#2	0.333	0.50	-0.53	-0.77	-0.93	-0.99
HOR ACC	-0.070	65	0.24	0.43	0.60	0.80
G,#2	0.209	0.25	-0.36	-0.53	-0.65	-0.76
CUSH PRESS	68.015	75	96.82	107.85	115.64	130.08
PSF	15.968	24.00	43.69	28.32	17.17	12.14
TRUNK PRESS	118.172	51	144.51	154.81	162.64	170.02
PSF	15.256	40.00	88.10	78.12	70.78	60.44

DAVIDSON LABORATORY

TABLE 7-4

28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 89 , 114

SPEED 15.0 MPH
WEIGHT 30000. LB
DRAG 13630. LB

WAVE ENCOUNTERS 37
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 638. CFS------FAN DRAG 3498. LB---------						
DRIVER ACC	-0.022	33	0.57	0.81		1.26
G,#3	0.324	0.60	-0.53	-0.68		-0.81
TROOP ACC	-0.012	57	0.48	0.70	0.88	1.06
G,#3	0.282	0.45	-0.43	-0.61	-0.70	-0.74
HOR ACC	0.133	38	0.50	0.68		1.22
G,#3	0.178	0.35	-0.13	-0.23		-0.38
CUSH PRESS	75.657	30	104.07	117.82		143.25
PSF	18.207	24.00	56.50	41.85		29.50
TRUNK PRESS	120.702	63	151.39	165.36	181.20	189.10
PSF	17.452	36.00	93.40	80.26	71.11	65.03

DAVIDSON LABORATORY | TABLE 7-5 | 28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 117 , 118

SPEED	25.0 MPH	WAVE ENCOUNTERS	36
WEIGHT	30000. LB	SEA STATE	2
DRAG	11260. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	11.258	35	17.44	20.55		23.81
KIPS	4.335	3.42	5.32	2.73		1.51
-----LVT 1---------FLOW 681. CFS------FAN DRAG 2158. LB---------						
DRIVER ACC	-0.009	50	1.70	2.48	2.96	3.09
G,#1	0.754	1.00	-0.73	-1.07	-1.22	-1.60
TROOP ACC	0.022	51	1.11	1.60	1.89	2.54
G,#1	0.550	0.90	-0.59	-0.89	-1.00	-1.05
HOR ACC	-0.120	44	0.27	0.46		0.64
G,#1	0.255	0.25	-0.46	-0.67		-1.10
CUSH PRESS	64.875	38	130.25	163.83		188.54
PSF	38.089	32.00	28.20	8.31		-21.52
TRUNK PRESS	116.196	79	208.02	263.91	301.48	324.11
PSF	47.074	48.00	70.40	48.76	36.57	16.97
-----LVT 2---------FLOW 635 CFS------FAN DRAG 1947 LB---------						
DRIVER ACC	0.004	49	1.26	2.09		2.58
G,#2	0.616	0.60	-0.62	-0.93		-1.14
TROOP ACC	0.006	44	0.69	0.94		1.34
G,#2	0.373	0.50	-0.51	-0.70		-0.94
HOR ACC	-0.028	44	0.30	0.48		0.62
G,#2	0.190	0.25	-0.30	-0.39		-0.54
CUSH PRESS	67.764	33	109.80	145.31		186.41
PSF	27.913	24.00	41.36	19.56		1.28
TRUNK PRESS	112.442	48	166.86	186.64		204.08
PSF	28.946	40.00	75.91	59.14		35.82

DAVIDSON LABORATORY

TABLE 7-5

28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 117, 118

SPEED 25.0 MPH
WEIGHT 30000. LB
DRAG 11260. LB

WAVE ENCOUNTERS 36
SEA STATE 2
LCG 110.0 IN

-----LVT 3---------FLOW 680. CFS------FAN DRAG 2180. LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	-0.008	46	0.88	1.36		2.03
G,#3	0.514	0.60	-0.58	-0.87		-1.03
TROOP ACC	-0.010	50	0.60	0.91	1.06	1.23
G,#3	0.382	0.45	-0.44	-0.66	-0.79	-0.90
HOR ACC	0.053	28	0.39	0.51		0.69
G,#3	0.189	0.35	-0.28	-0.39		-0.54
CUSH PRESS	67.241	47	100.54	113.66		124.11
PSF	25.004	24.00	35.06	5.24		-50.42
TRUNK PRESS	118.075	50	163.70	189.30	208.42	219.55
PSF	26.594	36.00	85.67	69.66	58.65	48.12

DAVIDSON LABORATORY

TABLE 7-6

28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 116 , 92

SPEED 30.0 MPH
WEIGHT 30000. LB
DRAG 12490. LB

WAVE ENCOUNTERS 28
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	12.487	23	18.43	21.66		27.77
KIPS	4.758	3.42	6.25	3.42		1.59
-----LVT 1---------FLOW 603. CFS------FAN DRAG 1540. LB---------						
DRIVER ACC	0.010	36	1.63	2.27		3.04
G,#1	0.783	1.00	-0.67	-1.07		-1.49
TROOP ACC	0.007	36	1.14	1.48		1.98
G,#1	0.608	0.90	-0.59	-0.97		-1.36
HOR ACC	-0.102	28	0.32	0.46		0.65
G,#1	0.282	0.25	-0.50	-0.65		-0.89
CUSH PRESS	72.210	50	135.46	161.10	177.21	199.81
PSF	38.430	32.00	38.43	14.61	6.57	1.96
TRUNK PRESS	112.444	32	200.27	235.35	251.36	268.34
PSF	45.396	48.00	67.74	46.80	35.36	29.10
-----LVT 2---------FLOW 590. CFS------FAN DRAG 1510. LB---------						
DRIVER ACC	-0.014	37	1.25	1.80		2.38
G,#2	0.692	0.60	-0.62	-0.98		-1.06
TROOP ACC	0.003	35	0.73	1.06		1.43
G,#2	0.415	0.50	-0.46	-0.72		-0.97
HOR ACC	-0.035	34	0.27	0.38		0.56
G,#2	0.203	0.25	-0.31	-0.47		-0.71
CUSH PRESS	73.757	45	131.26	161.11		191.94
PSF	33.340	24.00	43.73	17.51		3.45
TRUNK PRESS	112.471	35	165.04	181.27		191.24
PSF	31.311	40.00	76.82	58.59		39.06

DAVIDSON LABORATORY

TABLE 7-6

28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 116 , 92

SPEED 30.0 MPH
WEIGHT 30000. LB
DRAG 12490. LB

WAVE ENCOUNTERS 28
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 694. CFS------FAN DRAG 1842. LB---------						
DRIVER ACC	-0.025	33	1.07	1.57		2.49
G,#3	0.635	0.60	-0.70	-1.01		-1.18
TROOP ACC	-0.008	41	0.78	1.06		1.43
G,#3	0.483	0.45	-0.46	-0.85		-1.11
HOR ACC	0.070	22	0.49	0.68		0.99
G,#3	0.277	0.35	-0.34	-0.48		-0.59
CUSH PRESS	63.308	17	106.63	138.88		174.34
PSF	30.967	24.00	25.87	1.52		-10.70
TRUNK PRESS	116.740	35	167.73	192.31		218.70
PSF	31.739	36.00	80.71	61.19		47.84

DAVIDSON LABORATORY — TABLE 7-7 — 28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 120 , 119

SPEED 35.0 MPH — WAVE ENCOUNTERS 31
WEIGHT 30000. LB — SEA STATE 2
DRAG 14110. LB — LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	14.108	27	20.73	26.31		33.15
KIPS	5.463	3.42	7.45	4.11		2.22
-----LVT 1---------FLOW 650. CFS------FAN DRAG 1460. LB---------						
DRIVER ACC	-0.007	46	1.70	2.53		4.52
G,#1	0.873	1.00	-0.76	-1.16		-1.64
TROOP ACC	0.070	39	1.14	1.57		2.76
G,#1	0.590	0.90	-0.62	-0.90		-1.20
HOR ACC	-0.101	36	0.37	0.66		1.15
G,#1	0.325	0.25	-0.52	-0.78		-1.27
CUSH PRESS	67.405	60	132.57	165.06	183.09	212.86
PSF	42.140	32.00	28.96	-1.71	-17.34	-74.54
TRUNK PRESS	114.796	63	210.63	272.19	311.06	411.40
PSF	56.781	48.00	62.70	36.68	24.02	9.70
-----LVT 2---------FLOW 570. CFS------FAN DRAG 1210. LB---------						
DRIVER ACC	0.002	45	1.22	1.92		4.41
G,#2	0.693	0.60	-0.63	-1.00		-1.30
TROOP ACC	-0.001	40	0.95	1.53		3.28
G,#2	0.507	0.50	-0.51	-0.84		-1.10
HOR ACC	-0.037	42	0.28	0.49		0.69
G,#2	0.234	0.25	-0.38	-0.57		-0.80
CUSH PRESS	72.590	49	126.83	156.96		247.48
PSF	33.693	24.00	39.41	21.69		-1.60
TRUNK PRESS	108.930	40	164.54	187.01		210.75
PSF	33.673	40.00	69.87	49.86		24.99

DAVIDSON LABORATORY TABLE 7-7 28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 120, 119

SPEED 35.0 MPH
WEIGHT 30000. LB
DRAG 14110. LB

WAVE ENCOUNTERS 31
SEA STATE 2
LCG 110.0 IN

-----LVT 3---------FLOW 630. CFS------FAN DRAG 1440. LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	-0.006	43	1.22	1.83		2.32
G,#3	0.773	0.60	-0.72	-1.17		-1.53
TROOF ACC	-0.018	41	0.86	1.50		2.46
G,#3	0.630	0.45	-0.61	-1.00		-1.51
HOR ACC	0.058	27	0.62	1.07		1.55
G,#3	0.364	0.35	-0.43	-0.66		-1.01
CUSH PRESS	72.281	50	109.74	135.51	151.61	160.42
PSF	29.618	24.00	41.51	8.40	-14.39	-36.67
TRUNK PRESS	116.770	41	178.09	204.82		248.12
PSF	40.189	36.00	71.43	45.65		24.06

DAVIDSON LABORATORY | TABLE 7-8 | 28-OCT-82

ACV BARGE TRAIN

THREE UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 93 , 121

SPEED 44.7 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 26
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 1---------FLOW		CFS------FAN DRAG			LB---------	
DRIVER ACC	-0.021	25	2.08	2.92		3.67
G,#1	1.004	1.00	-0.96	-1.23		-1.37
TROOF ACC	0.002	20	1.03	1.46		1.72
G,#1	0.529	0.90	-0.63	-0.91		-1.26
HOR ACC	-0.078	23	0.40	0.63		0.93
G,#1	0.326	0.25	-0.48	-0.74		-0.90
CUSH PRESS	68.089	38	136.70	179.39		202.94
PSF	44.714	32.00	29.05	1.41		-12.90
TRUNK PRESS						
PSF						
-----LVT 2---------FLOW	580. CFS------FAN DRAG			980. LB---------		
DRIVER ACC	0.014	32	1.32	2.20		3.26
G,#2	0.786	0.60	-0.55	-1.04		-1.28
TROOF ACC	-0.002	25	0.99	1.46		1.79
G,#2	0.523	0.50	-0.55	-0.82		-1.07
HOR ACC	-0.027	24	0.22	0.38		0.52
G,#2	0.194	0.25	-0.31	-0.46		-0.73
CUSH PRESS	72.506	38	133.31	166.68		220.89
PSF	36.718	24.00	45.18	15.93		1.72
TRUNK PRESS	110.244	26	169.52	198.29		218.91
PSF	39.101	40.00	67.20	41.68		30.11

DAVIDSON LABORATORY

TABLE 7-8

ACV BARGE TRAIN

(Continued)

28-OCT-82

RUN 93 , 121

SPEED 44.7 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 26
SEA STATE 2
LCG 110.0 IN

-----LVT 3---------FLOW CFS------FAN DRAG LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	-0.015	31	1.13	1.70		2.50
G,#3	0.659	0.60	-0.63	-0.94		-1.25
TROOF ACC	-0.012	31	0.63	1.03		1.62
G,#3	0.424	0.45	-0.46	-0.71		-1.01
HOR ACC	0.036	7	0.36			0.62
G,#3	0.174	0.35	-0.23			-0.38
CUSH PRESS						
PSF						
TRUNK PRESS	116.539	29	170.68	190.60		214.90
PSF	32.750	36.00	78.79	55.81		41.01

DAVIDSON LABORATORY　　TABLE 8-1　　16-SEP-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 94

SPEED 5.0 MPH
WEIGHT 30000. LB
DRAG 1760. LB

WAVE ENCOUNTERS 46
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	1.760	46	4.58	5.46		6.24
KIPS	1.279	3.42	-0.25	-0.47		-0.63
-----LVT 1---------FLOW 640. CFS------FAN DRAG 9660. LB---------						
TROOP ACC	-0.189	46	0.23	0.33		0.42
G,#1	0.142	0.60	-0.54	-0.61		-0.78
HOR ACC	-0.078	50	0.09	0.15	0.19	0.20
G,#1	0.082	0.25	-0.25	-0.29	-0.31	-0.32
CUSH PRESS	65.540	36	89.85	99.89		117.03
PSF	6.613	32.00	47.56	43.93		42.21
TRUNK PRESS	110.821	72	143.60	153.23	158.21	161.65
PSF	10.678	48.00	85.97	80.55	78.20	74.36
-----LVT 2---------FLOW 630. CFS------FAN DRAG 9180. LB---------						
DRIVER ACC	-0.003	68	0.34	0.40	0.43	0.50
G,#2	0.150	0.60	-0.39	-0.47	-0.51	-0.52
TROOP ACC	-0.016	66	0.34	0.43	0.49	0.52
G,#2	0.141	0.50	-0.33	-0.42	-0.49	-0.53
HOR ACC	-0.074	40	0.11	0.16		0.21
G,#2	0.079	0.25	-0.26	-0.31		-0.35
CUSH PRESS	63.462	24	83.82	95.65		113.21
PSF	5.681	24.00	47.70	40.17		31.76
TRUNK PRESS	107.210	22	132.41	135.83		137.62
PSF	8.180	40.00	85.40	82.13		77.16

TABLE 8-1

ACV BARGE TRAIN

(Continued)

RUN 94

SPEED 5.0 MPH
WEIGHT 30000. LB
DRAG 1760. LB

WAVE ENCOUNTERS 46
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 710. CFS------FAN DRAG 10890. LB---------						
DRIVER ACC	0.040	33	0.61	0.71		1.32
G,#3	0.227	1.00	-0.56	-0.65		-0.73
CUSH PRESS	57.586	132	76.26	85.28	90.12	97.47
PSF	10.997	24.00	41.92	31.48	25.93	13.47
TRUNK PRESS	112.956	170	137.78	144.37	150.79	164.14
PSF	10.686	36.00	91.28	85.33	81.39	76.70
-----LVT 4---------FLOW CFS------FAN DRAG LB---------						
DRIVER ACC	-0.023	84	0.44	0.58	0.68	0.83
G,#4	0.172	0.60	-0.39	-0.51	-0.64	-0.84
TROOP ACC	-0.019	84	0.35	0.46	0.58	0.75
G,#4	0.169	0.50	-0.38	-0.50	-0.61	-0.71
HOR ACC	0.063	12	0.28	0.33	0.36	0.36
G,#4	0.076	0.40	-0.18	-0.20	-0.21	-0.21
CUSH PRESS	66.664	114	83.79	90.31	95.03	97.39
PSF	8.784	24.00	49.00	42.74	34.83	26.46
TRUNK PRESS						
PSF						

DAVIDSON LABORATORY

TABLE 8-2

ACV BARGE TRAIN

17-SEP-82

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 98

SPEED 10.0 MPH
WEIGHT 30000. LB
DRAG 15880. LB

WAVE ENCOUNTERS 48
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	15.882	53	20.80	23.74	25.54	27.62
KIPS	3.900	3.42	10.13	7.50	5.87	4.72
-----LVT 1---------FLOW 650. CFS------FAN DRAG 4750. LB---------						
DRIVER ACC	-0.033	44	0.62	0.77		0.89
G,#1	0.264	1.00	-0.63	-0.76		-0.98
TROOP ACC						
G,#1						
HOR ACC	-0.045	55	0.17	0.24	0.28	0.37
G,#1	0.119	0.25	-0.25	-0.35	-0.40	-0.43
CUSH PRESS	59.973	81	96.29	121.88	139.80	149.26
PSF	18.601	32.00	35.16	24.20	18.29	11.51
TRUNK PRESS	106.962	72	152.84	186.03	242.17	365.33
PSF	17.789	48.00	76.20	65.10	59.61	52.54
-----LVT 2---------FLOW 690. CFS------FAN DRAG 5260. LB---------						
DRIVER ACC	0.008	57	0.43	0.57	0.64	0.70
G,#2	0.209	0.60	-0.42	-0.56	-0.64	-0.68
TROOP ACC	-0.001	63	0.36	0.48	0.57	0.67
G,#2	0.192	0.50	-0.39	-0.54	-0.62	-0.65
HOR ACC	-0.022	39	0.20	0.27		0.36
G,#2	0.111	0.25	-0.23	-0.31		-0.35
CUSH PRESS	57.866	72	81.45	103.08	128.02	150.20
PSF	12.437	24.00	40.26	30.72	26.25	19.43
TRUNK PRESS	111.218	82	135.94	143.01	149.10	157.43
PSF	11.947	40.00	84.10	76.60	71.54	66.64

DAVIDSON LABORATORY

TABLE 8-2

ACV BARGE TRAIN

(Continued)

17-SEP-82

RUN 98

SPEED 10.0 MPH
WEIGHT 30000. LB
DRAG 15880. LB

WAVE ENCOUNTERS 48
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 730. CFS------FAN DRAG 5820. LB---------						
DRIVER ACC	-0.009	58	0.46	0.60	0.73	0.90
G,#3	0.218	0.60	-0.43	-0.57	-0.69	-0.76
TROOP ACC	-0.005	75	0.39	0.54	0.60	0.70
G,#3	0.206	0.45	-0.32	-0.48	-0.57	-0.68
HOR ACC						
G,#3						
CUSH PRESS	58.394	94	79.92	98.35	118.55	150.57
PSF	14.848	24.00	37.64	23.01	13.43	-17.43
TRUNK PRESS	117.176	108	144.29	155.10	161.79	176.69
PSF	13.620	36.00	92.99	83.88	78.81	66.17
-----LVT 4---------FLOW 600. CFS------FAN DRAG 4520. LB---------						
DRIVER ACC	-0.008	64	0.40	0.54	0.66	0.76
G,#4	0.209	0.60	-0.45	-0.59	-0.68	-0.77
TROOP ACC	-0.017	59	0.39	0.55	0.67	0.76
G,#4	0.204	0.50	-0.39	-0.56	-0.68	-0.78
HOR ACC	0.042	17	0.33	0.42		0.47
G,#4	0.113	0.40	-0.22	-0.28		-0.33
CUSH PRESS	69.113	69	89.38	99.89	111.63	117.33
PSF	11.374	24.00	48.73	38.91	32.43	26.07
TRUNK PRESS						
PSF						

TABLE 8-3

PAGE 1

ACV BARGE TRAIN

DAVIDSON LABORATORY

16-SEP-82

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 95

SPEED	12.5 MPH		WAVE ENCOUNTERS	43
WEIGHT	30000. LB		SEA STATE	2
DRAG	LB		LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 1---------FLOW 700. CFS------FAN DRAG 4610. LB---------						
DRIVER ACC	-0.010	60	0.68	0.90	1.03	1.19
G,#1	0.337	1.00	-0.72	-0.90	-0.98	-1.07
TROOP ACC	-0.019	72	0.49	0.71	0.85	1.19
G,#1	0.292	0.60	-0.52	-0.72	-0.83	-1.05
HOR ACC	-0.121	57	0.13	0.25	0.31	0.38
G,#1	0.154	0.25	-0.37	-0.48	-0.56	-0.65
CUSH PRESS	65.304	87	89.44	98.27	106.37	112.43
PSF	12.885	32.00	41.53	31.65	25.50	21.87
TRUNK PRESS	120.160	132	163.09	192.71	230.98	442.92
PSF	23.668	48.00	85.47	70.83	61.66	50.92
-----LVT 2---------FLOW 580. CFS------FAN DRAG 3520. LB---------						
DRIVER ACC	0.001	65	0.41	0.56	0.68	0.75
G,#2	0.216	0.60	-0.45	-0.61	-0.72	-0.81
TROOP ACC	-0.009	95	0.38	0.59	0.74	0.88
G,#2	0.243	0.50	-0.40	-0.59	-0.72	-0.86
HOR ACC	-0.064	51	0.19	0.30	0.36	0.41
G,#2	0.150	0.25	-0.31	-0.41	-0.45	-0.50
CUSH PRESS	74.514	45	89.14	93.86		100.88
PSF	5.993	24.00	59.50	55.45		50.82
TRUNK PRESS	111.628	134	140.66	155.68	168.30	192.50
PSF	15.525	40.00	83.85	71.43	64.26	51.71

TABLE 8-3
ACV BARGE TRAIN
(Continued)

DAVIDSON LABORATORY 16-SEP-82

RUN 95

SPEED 12.5 MPH
WEIGHT 30000. LB
DRAG 20470. LB

WAVE ENCOUNTERS 43
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 710. CFS------FAN DRAG 4350. LB---------						
DRIVER ACC	0.012	116	0.48	0.68	0.83	1.09
G,#3	0.276	0.60	-0.44	-0.68	-0.84	-0.96
CUSH PRESS	57.740	80	79.94	89.97	95.84	117.29
PSF	12.790	24.00	42.62	29.20	18.03	-21.00
TRUNK PRESS	113.056	163	141.00	154.21	162.29	175.65
PSF	16.588	36.00	89.57	77.44	70.43	59.06
-----LVT 4---------FLOW 570. CFS------FAN DRAG 3310. LB---------						
DRIVER ACC	0.001	64	0.47	0.64	0.76	0.92
G,#4	0.249	0.60	-0.46	-0.61	-0.72	-0.78
TROOP ACC	-0.010	76	0.40	0.60	0.81	0.98
G,#4	0.235	0.50	-0.39	-0.53	-0.63	-0.76
HOR ACC	0.099	22	0.46	0.61		0.94
G,#4	0.149	0.40	-0.17	-0.26		-0.36
CUSH PRESS	69.363	98	88.06	95.16	100.84	103.53
PSF	12.434	24.00	48.45	36.19	25.54	12.65
TRUNK PRESS						
PSF						

DAVIDSON LABORATORY

TABLE 8-4

ACV BARGE TRAIN

17-SEP-82

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 99

SPEED 12.5 MPH
WEIGHT 30000. LB
DRAG 20470. LB

WAVE ENCOUNTERS 42
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	22.353	46	30.98	35.49		39.03
KIPS	6.322	3.42	14.27	10.56		3.89
-----LVT 1---------FLOW 730. CFS------FAN DRAG 4560. LB---------						
DRIVER ACC	-0.011	48	0.67	0.87		1.01
G,#1	0.318	1.00	-0.70	-0.84		-0.99
TROOP ACC	0.032	95	0.69	0.89	1.02	1.32
G,#1	0.351	0.90	-0.61	-0.89	-1.07	-1.28
HOR ACC	-0.117	52	0.14	0.24	0.32	0.43
G,#1	0.155	0.25	-0.39	-0.49	-0.57	-0.59
CUSH PRESS						
PSF						
TRUNK PRESS	113.776	64	159.22	183.84	221.23	341.89
PSF	18.193	48.00	83.22	71.53	62.70	54.96
-----LVT 2---------FLOW 620. CFS------FAN DRAG 3780. LB---------						
DRIVER ACC	-0.007	41	0.43	0.58		0.91
G,#2	0.203	0.60	-0.43	-0.55		-0.64
TROOP ACC	-0.002	56	0.42	0.56	0.66	0.72
G,#2	0.227	0.50	-0.40	-0.55	-0.63	-0.66
HOR ACC	-0.026	53	0.23	0.33	0.41	0.47
G,#2	0.162	0.25	-0.28	-0.40	-0.48	-0.54
CUSH PRESS	68.277	44	86.65	93.41		99.01
PSF	8.358	24.00	50.95	46.43		40.35
TRUNK PRESS	111.299	41	138.80	146.13		158.27
PSF	13.189	40.00	82.34	75.50		70.80

DAVIDSON LABORATORY

TABLE 8-4

ACV BARGE TRAIN

(Continued)

RUN 99

SPEED	12.5 MPH	WAVE ENCOUNTERS	42
WEIGHT	30000. LB	SEA STATE	2
DRAG	20470. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW	730. CFS------FAN DRAG		4620. LB---------			
DRIVER ACC	-0.016	42	0.46	0.63		0.85
G,#3	0.246	0.60	-0.51	-0.65		-0.81
TROOF ACC	-0.007	65	0.37	0.53	0.64	0.74
G,#3	0.231	0.45	-0.39	-0.59	-0.78	-0.99
HOR ACC						
G,#3						
CUSH PRESS						
PSF						
TRUNK PRESS	115.334	56	141.10	148.44	153.01	157.14
PSF	13.349	36.00	89.84	81.56	75.31	69.17
-----LVT 4---------FLOW	CFS------FAN DRAG		LB---------			
DRIVER ACC	-0.007	45	0.47	0.65		0.92
G,#4	0.241	0.60	-0.45	-0.60		-0.81
TROOF ACC	-0.014	53	0.44	0.65	0.84	1.02
G,#4	0.235	0.50	-0.39	-0.55	-0.65	-0.70
HOR ACC	0.037	26	0.38	0.54		0.87
G,#4	0.157	0.40	-0.23	-0.33		-0.45
CUSH PRESS	68.461	55	87.59	94.08	98.35	101.23
PSF	11.311	24.00	47.71	38.08	31.44	25.69
TRUNK PRESS						
PSF						

DAVIDSON LABORATORY | TABLE 8-5 | 17-SEP-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 100

SPEED 15.0 MPH
WEIGHT 30000. LB
DRAG 17820. LB

WAVE ENCOUNTERS 42
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	17.816	54	24.54	31.90	34.57	37.67
KIPS	7.446	3.42	7.94	2.78	-1.35	-6.56
-----LVT 1---------FLOW		CFS------FAN DRAG			LB---------	
DRIVER ACC	-0.005	49	0.87	1.20		2.03
G,#1	0.421	1.00	-0.73	-1.02		-1.45
TROOP ACC						
G,#1						
HOR ACC	-0.113	47	0.22	0.40		0.79
G,#1	0.231	0.25	-0.46	-0.60		-0.77
CUSH PRESS	66.317	57	96.51	110.65	128.80	145.81
PSF	16.646	32.00	39.02	26.56	17.84	9.98
TRUNK PRESS						
PSF						
-----LVT 2---------FLOW	670. CFS------FAN DRAG			3810. LB---------		
DRIVER ACC	-0.001	42	0.64	0.85		1.30
G,#2	0.336	0.60	-0.55	-0.71		-0.85
TROOP ACC	-0.007	45	0.51	0.73		1.02
G,#2	0.318	0.50	-0.53	-0.72		-0.93
HOR ACC	-0.069	47	0.29	0.47		0.76
G,#2	0.242	0.25	-0.39	-0.57		-1.03
CUSH PRESS	74.275	59	102.02	113.21	120.75	127.04
PSF	16.784	24.00	47.78	32.56	23.04	15.69
TRUNK PRESS	124.598	50	159.40	171.06	180.76	188.25
PSF	17.166	40.00	94.28	83.20	77.80	65.81

DAVIDSON LABORATORY　　TABLE 8-5　　17-SEP-82

ACV BARGE TRAIN

(Continued)

RUN 100

SPEED	15.0 MPH	WAVE ENCOUNTERS	42
WEIGHT	30000. LB	SEA STATE	2
DRAG	17820. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 640. CFS------FAN DRAG 3480. LB---------						
DRIVER ACC	-0.010	37	0.73	1.03		1.58
G,#3	0.382	0.60	-0.56	-0.85		-1.15
TROOP ACC	-0.014	53	0.47	0.73	0.84	0.95
G,#3	0.334	0.45	-0.50	-0.76	-0.98	-1.33
HOR ACC						
G,#3						
CUSH PRESS	73.699	69	99.58	115.39	128.61	137.89
PSF	18.873	24.00	45.93	27.27	19.76	11.49
TRUNK PRESS	119.279	51	155.27	168.51	177.82	188.72
PSF	19.421	36.00	91.76	77.09	69.17	67.67
-----LVT 4---------FLOW CFS------FAN DRAG LB---------						
DRIVER ACC	0.006	35	0.63	0.84		1.15
G,#4	0.321	0.60	-0.51	-0.71		-0.92
TROOP ACC	-0.015	37	0.49	0.71		1.06
G,#4	0.300	0.50	-0.50	-0.68		-0.99
HOR ACC	0.125	28	0.53	0.70		0.89
G,#4	0.202	0.40	-0.18	-0.30		-0.50
CUSH PRESS	84.014	50	104.75	112.46	118.94	124.62
PSF	14.636	24.00	61.04	48.65	40.57	30.67
TRUNK PRESS						
PSF						

DAVIDSON LABORATORY

TABLE 8-6

28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 101 , 108

SPEED	20.0 MPH	WAVE ENCOUNTERS	42
WEIGHT	30000. LB	SEA STATE	2
DRAG	14240. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	14.241	45	21.21	25.31		29.39
KIPS	5.515	3.42	6.49	3.57		0.05
-----LVT 1----------FLOW	669. CFS------FAN DRAG	2822. LB---------				
DRIVER ACC	-0.016	65	1.32	2.19	3.09	3.54
G,#1	0.636	1.00	-0.77	-1.12	-1.25	-1.30
TROOP ACC	0.041	69	0.89	1.17	1.38	1.73
G,#1	0.417	0.90	-0.58	-0.84	-1.00	-1.24
HOR ACC	-0.099	56	0.26	0.45	0.56	0.68
G,#1	0.241	0.25	-0.43	-0.56	-0.66	-0.81
CUSH PRESS	74.132	91	122.43	151.76	182.10	199.81
PSF	28.641	32.00	42.35	23.90	11.30	2.74
TRUNK PRESS	123.719	42	195.04	245.24		312.79
PSF	35.961	48.00	80.90	63.33		47.69
-----LVT 2----------FLOW	740. CFS------FAN DRAG	2790. LB---------				
DRIVER ACC	0.003	52	0.89	1.42	1.89	2.71
G,#2	0.507	0.60	-0.64	-0.93	-1.06	-1.30
TROOP ACC	0.007	53	0.55	0.82	0.96	1.06
G,#2	0.347	0.50	-0.53	-0.75	-0.85	-0.95
HOR ACC	-0.052	47	0.31	0.47		0.92
G,#2	0.234	0.25	-0.41	-0.59		-0.85
CUSH PRESS	49.820	71	88.02	116.95	141.16	218.82
PSF	33.716	24.00	15.90	-25.44	-46.05	-59.96
TRUNK PRESS	110.656	53	152.89	169.88	182.01	199.08
PSF	21.469	40.00	77.77	63.63	56.37	51.65

DAVIDSON LABORATORY

TABLE 8-6

ACV BARGE TRAIN

(Continued)

28-OCT-82

RUN 101 , 108

SPEED 20.0 MPH
WEIGHT 30000. LB
DRAG 14240. LB

WAVE ENCOUNTERS 42
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 775 CFS------FAN DRAG 3037 LB---------						
DRIVER ACC	-0.028	39	0.87	1.35		2.14
G,#3	0.451	0.60	-0.64	-0.88		-1.01
TROOP ACC	-0.003	45	0.47	0.73		1.29
G,#3	0.258	0.45	-0.41	-0.54		-0.70
HOR ACC	0.022	15	0.28	0.38		0.49
G,#3	0.157	0.35	-0.30	-0.40		-0.42
CUSH PRESS	48.516	19	90.73	131.14		172.35
PSF	28.147	24.00	11.56	-18.12		-59.55
TRUNK PRESS	114.997	48	158.52	183.22		214.29
PSF	23.803	36.00	81.58	65.98		55.64
-----LVT 4---------FLOW 713 CFS------FAN DRAG 2644 LB---------						
DRIVER ACC	0.002	19	0.76	1.03		1.20
G,#4	0.483	0.60	-0.72	-0.99		-1.28
TROOP ACC	-0.012	32	0.59	0.92		1.36
G,#4	0.291	0.50	-0.46	-0.66		-0.79
HOR ACC	0.059	28	0.41	0.57		0.87
G,#4	0.184	0.40	-0.26	-0.35		-0.46
CUSH PRESS	52.530	38	86.16	108.38		148.49
PSF	27.019	24.00	9.28	-24.55		-62.75
TRUNK PRESS	108.825	40	127.78	156.20		179.87
PSF	34.953	36.00	38.90	-31.92		-88.76

DAVIDSON LABORATORY

20-SEP-82

TABLE 8-7

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 105

SPEED 25.0 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 21
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 1----------FLOW 650. CFS------FAN DRAG 2120. LB---------						
DRIVER ACC	-0.026	25	1.70	2.48		3.34
G,#1	0.781	1.00	-0.81	-1.10		-1.26
TROOP ACC	0.007	24	1.06	1.46		1.56
G,#1	0.556	0.90	-0.60	-0.93		-1.00
HOR ACC	-0.086	21	0.36	0.53		0.77
G,#1	0.286	0.25	-0.47	-0.67		-0.96
CUSH PRESS	71.018	36	131.69	161.52		184.65
PSF	35.114	32.00	34.22	11.91		-37.18
TRUNK PRESS	118.541	37	205.84	253.73		297.43
PSF	44.161	48.00	74.58	54.96		40.41
-----LVT 2----------FLOW 660. CFS------FAN DRAG 1910. LB---------						
DRIVER ACC	0.002	26	1.31	2.01		2.79
G,#2	0.647	0.60	-0.66	-0.89		-1.03
TROOP ACC	0.002	23	0.76	1.14		1.75
G,#2	0.434	0.50	-0.52	-0.75		-1.03
HOR ACC	-0.066	23	0.25	0.49		0.76
G,#2	0.240	0.25	-0.39	-0.53		-0.75
CUSH PRESS	57.798	38	112.27	152.22		218.39
PSF	33.088	24.00	27.63	3.52		-72.90
TRUNK PRESS	106.022	26	160.35	178.35		202.42
PSF	28.185	40.00	70.68	57.20		44.98

DAVIDSON LABORATORY

20-SEP-82

TABLE 8-7

ACV BARGE TRAIN

(Continued)

RUN 105

SPEED 25.0 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 21
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 650. CFS------FAN DRAG 2070. LB---------						
DRIVER ACC	-0.015	26	0.91	1.34		1.77
G,#3	0.541	0.60	-0.58	-0.91		-1.24
TROOP ACC	-0.011	25	0.56	0.83		1.18
G,#3	0.381	0.45	-0.46	-0.76		-1.10
HOR ACC	0.006	17	0.41	0.62		0.78
G,#3	0.274	0.35	-0.43	-0.62		-0.86
CUSH PRESS	71.843	38	112.23	139.07		190.85
PSF	31.139	24.00	44.74	19.80		-89.51
TRUNK PRESS	117.961	27	165.91	187.13		205.26
PSF	27.645	36.00	84.66	67.67		50.38
-----LVT 4---------FLOW CFS------FAN DRAG LB---------						
DRIVER ACC	-0.005	20	1.14	1.81		3.11
G,#4	0.600	0.60	-0.75	-0.99		-1.13
TROOP ACC	-0.016	19	0.74	1.16		1.53
G,#4	0.378	0.50	-0.51	-0.66		-0.72
HOR ACC	0.058	13	0.52	0.68		0.82
G,#4	0.226	0.40	-0.31	-0.44		-0.55
CUSH PRESS	69.207	22	104.95	119.02		132.74
PSF	24.232	24.00	36.87	16.00		-20.21
TRUNK PRESS						
PSF						

DAVIDSON LABORATORY TABLE 8-8 28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 109 , 102

SPEED 30.0 MPH
WEIGHT 30000. LB
DRAG 14930. LB

WAVE ENCOUNTERS 30
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	14.934	41	19.48	22.97	24.39	25.30
KIPS	3.908	3.42	10.08	7.60	7.01	6.46
-----LVT 1---------FLOW 710. CFS------FAN DRAG 2000. LB---------						
DRIVER ACC	0.001	53	1.65	2.56	3.04	3.26
G,#1	0.792	1.00	-0.77	-1.15	-1.29	-1.39
TROOP ACC	-0.003	24	1.03	1.46		1.94
G,#1	0.552	0.90	-0.59	-0.88		-1.03
HOR ACC	-0.064	40	0.29	0.49		0.68
G,#1	0.237	0.25	-0.38	-0.56		-0.79
CUSH PRESS	69.110	65	128.24	155.29	168.03	172.44
PSF	33.609	32.00	35.12	15.00	3.35	-0.78
TRUNK PRESS	124.653	87	212.09	272.63	314.14	329.76
PSF	51.372	48.00	76.93	53.40	38.98	23.44
-----LVT 2---------FLOW 600. CFS------FAN DRAG 1530. LB---------						
DRIVER ACC	0.013	58	1.08	1.71	2.26	2.91
G,#2	0.637	0.60	-0.62	-0.97	-1.13	-1.27
TROOP ACC	-0.001	46	0.74	1.06		1.34
G,#2	0.404	0.50	-0.48	-0.73		-0.89
HOR ACC	-0.033	46	0.23	0.35		0.57
G,#2	0.165	0.25	-0.27	-0.35		-0.48
CUSH PRESS	72.103	63	118.02	153.99	173.63	211.93
PSF	27.757	24.00	42.92	23.48	15.46	6.55
TRUNK PRESS	112.231	52	159.39	178.77	189.92	205.75
PSF	27.993	40.00	76.38	59.88	53.73	46.65

DAVIDSON LABORATORY

TABLE 8-8

28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 109 , 102

SPEED 30.0 MPH
WEIGHT 30000. LB
DRAG 14930. LB

WAVE ENCOUNTERS 30
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 640. CFS------FAN DRAG 1680. LB---------						
DRIVER ACC G,#3	0.004 0.557	48 0.60	0.96 -0.62	1.47 -0.92		1.91 -1.14
TROOP ACC G,#3	-0.006 0.334	39 0.45	0.57 -0.42	0.78 -0.60		1.03 -0.79
HOR ACC G,#3	0.017 0.212	15 0.35	0.36 -0.31	0.50 -0.42		0.83 -0.54
CUSH PRESS PSF	71.031 15.155	41 24.00	94.57 49.08	106.99 36.78		149.21 25.25
TRUNK PRESS PSF	115.997 24.299	46 36.00	159.02 85.93	179.04 72.32		202.26 57.89
-----LVT 4---------FLOW 599 CFS------FAN DRAG 1478 LB---------						
DRIVER ACC G,#4	-0.003 0.487	23 0.60	0.90 -0.60	1.52 -0.79		2.07 -1.02
TROOP ACC G,#4	-0.041 0.315	42 0.50	0.53 -0.43	0.85 -0.60		1.58 -0.72
HOR ACC G,#4	0.048 0.135	14 0.40	0.32 -0.27			0.43 -0.40
CUSH PRESS PSF	68.941 21.322	20 24.00	99.13 41.53	113.02 24.94		126.66 7.79
TRUNK PRESS PSF	108.658 43.206	40 36.00	148.06 44.79	195.19 -27.44		272.56 -80.90

DAVIDSON LABORATORY — TABLE 8-9 — 28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 106 , 111

SPEED	34.8 MPH	WAVE ENCOUNTERS	29
WEIGHT	30000. LB	SEA STATE	2
DRAG	17770. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	17.768	31	25.11	30.51		35.82
KIPS	6.026	3.42	11.15	7.47		5.15
-----LVT 1---------FLOW 570. CFS------FAN DRAG 1240. LB---------						
DRIVER ACC	-0.003	39	1.86	2.77		4.34
G,#1	0.899	1.00	-0.84	-1.21		-1.37
TROOF ACC	0.010	43	1.05	1.51		2.04
G,#1	0.589	0.90	-0.66	-0.98		-1.19
HOR ACC	-0.037	39	0.47	0.67		0.86
G,#1	0.339	0.25	-0.50	-0.73		-0.94
CUSH PRESS	76.030	61	137.54	172.97	190.05	206.11
PSF	39.910	32.00	42.50	10.26	-3.59	-39.76
TRUNK PRESS	111.795	65	205.34	270.06	314.98	353.20
PSF	54.256	48.00	66.87	37.44	28.06	18.59
-----LVT 2---------FLOW 640. CFS------FAN DRAG 1350. LB---------						
DRIVER ACC	0.013	44	1.29	2.04		2.49
G,#2	0.746	0.60	-0.69	-1.08		-1.35
TROOF ACC	-0.003	38	0.83	1.25		1.88
G,#2	0.518	0.50	-0.56	-0.90		-1.07
HOR ACC	-0.058	38	0.29	0.44		0.64
G,#2	0.229	0.25	-0.39	-0.53		-0.62
CUSH PRESS	62.992	48	118.78	149.82		181.29
PSF	33.416	24.00	30.62	9.41		-9.59
TRUNK PRESS	108.214	40	164.58	188.97		213.24
PSF	35.541	40.00	67.49	45.04		21.66

DAVIDSON LABORATORY | TABLE 8-9 | 28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 106, 111

SPEED 34.8 MPH
WEIGHT 30000. LB
DRAG 17770. LB

WAVE ENCOUNTERS 29
SEA STATE 2
LCG 110.0 IN

-----LVT 3---------FLOW 618. CFS------FAN DRAG 1428. LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	0.003	40	1.18	1.89		3.06
G,#3	0.688	0.60	-0.69	-1.04		-1.13
TROOP ACC	-0.007	43	0.67	1.03		1.55
G,#3	0.443	0.45	-0.49	-0.76		-0.99
HOR ACC	0.020	30	0.56	0.77		0.93
G,#3	0.335	0.35	-0.48	-0.70		-0.92
CUSH PRESS	75.600	23	131.57	162.92		206.75
PSF	37.514	24.00	33.74	9.62		-1.48
TRUNK PRESS	117.932	39	170.62	196.70		218.05
PSF	32.802	36.00	79.08	59.40		45.86

-----LVT 4---------FLOW 623. CFS------FAN DRAG 1329. LB---------

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRIVER ACC	0.006	21	1.43	2.15		2.73
G,#4	0.819	0.60	-0.66	-1.25		-1.38
TROOP ACC	-0.039	[illegible]7	0.97	1.49		1.89
G,#4	0.592	[illegible]	-0.65	-1.[illegible]1		-1.13
HOR ACC	0.008	21	0.54	0.77		0.98
G,#4	0.300	0.40	-0.46	-0.69		-1.00
CUSH PRESS	66.032	39	107.54	141.27		205.25
PSF	30.863	24.00	33.35	14.84		0.40
TRUNK PRESS	108.975	32	150.44	205.44		267.06
PSF	40.898	36.00	51.79	0.36		-61.27

DAVIDSON LABORATORY

TABLE 8-10

28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

RUN 110 , 107

SPEED 44.7 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 25
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 1---------FLOW 650. CFS------FAN DRAG 1080. LB---------						
DRIVER ACC	-0.008	35	2.23	3.28		4.09
G,#1	1.041	1.00	-0.88	-1.25		-1.48
TROOF ACC	-0.006	29	1.17	1.62		2.21
G,#1	0.626	0.90	-0.69	-1.03		-1.25
HOR ACC	-0.044	35	0.44	0.61		0.85
G,#1	0.340	0.25	-0.45	-0.73		-1.26
CUSH PRESS	62.188	46	130.44	172.30		199.61
PSF	43.813	32.00	21.43	-6.24		-25.15
TRUNK PRESS	109.011	54	212.36	301.97	343.37	360.48
PSF	64.101	48.00	57.51	30.22	19.40	15.36
-----LVT 2---------FLOW 610. CFS------FAN DRAG 970. LB---------						
DRIVER ACC	0.006	36	1.70	2.78		4.14
G,#2	0.872	0.60	-0.74	-1.16		-1.42
TROOF ACC	-0.006	39	1.01	1.55		2.20
G,#2	0.548	0.50	-0.53	-0.78		-0.96
HOR ACC	-0.048	35	0.29	0.51		0.96
G,#2	0.257	0.25	-0.38	-0.56		-0.76
CUSH PRESS	64.346	48	123.77	166.31		203.04
PSF	38.921	24.00	31.66	6.69		-11.51
TRUNK PRESS	105.158	32	175.37	195.98		213.24
PSF	40.271	40.00	63.20	37.48		19.99

DAVIDSON LABORATORY

TABLE 8-10

28-OCT-82

ACV BARGE TRAIN

(Continued)

RUN 110 , 107

SPEED	44.7 MPH	WAVE ENCOUNTERS	25
WEIGHT	30000. LB	SEA STATE	2
DRAG	LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 642 CFS------FAN DRAG 1145. LB---------						
DRIVER ACC	0.023	22	1.03	1.50		1.86
G,#3	0.618	0.60	-0.60	-0.96		-1.29
TROOP ACC	0.004	36	0.83	1.22		1.97
G,#3	0.447	0.45	-0.46	-0.70		-0.96
HOR ACC	-0.004	24	0.39	0.63		0.95
G,#3	0.268	0.35	-0.42	-0.64		-0.82
CUSH PRESS	71.230	23	135.38	171.61		210.45
PSF	41.951	24.00	30.83	7.21		1.11
TRUNK PRESS	116.916	40	171.99	193.93		209.02
PSF	35.375	36.00	78.44	52.79		29.32
-----LVT 4---------FLOW 600. CFS------FAN DRAG 1000. LB---------						
DRIVER ACC						
G,#4						
TROOP ACC	-0.047	33	0.87	1.44		2.64
G,#4	0.544	0.50	-0.61	-0.88		-1.15
HOR ACC	0.026	16	0.43	0.57		0.77
G,#4	0.258	0.40	-0.45	-0.70		-1.13
CUSH PRESS	68.011	31	114.08	134.43		179.49
PSF	30.422	24.00	39.06	13.76		0.40
TRUNK PRESS	108.416	55	167.75	229.81	262.87	315.76
PSF	54.359	36.00	46.30	-14.97	-52.89	-92.69

DAVIDSON LABORATORY TABLE 9-1 22-SEP-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 123

SPEED 5.0 MPH
WEIGHT 30000. LB
DRAG 1670. LB

WAVE ENCOUNTERS 77
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	1.673	39	4.65	5.79		7.55
KIPS	1.341	3.42	0.02	-0.18		-0.53
-----LVT 1---------FLOW	700. CFS------FAN DRAG 10630. LB---------					
DRIVER ACC	-0.011	10	0.64			0.97
G,#1	0.180	1.00	-0.58			-0.69
TROOP ACC	0.003	4	0.72			0.76
G,#1	0.141	0.90	-0.39			-0.44
HOR ACC	-0.066	39	0.14	0.21		0.28
G,#1	0.082	0.25	-0.23	-0.28		-0.33
CUSH PRESS	58.316	42	93.43	122.29		181.94
PSF	11.357	32.00	35.96	26.07		11.07
TRUNK PRESS	112.052	72	158.94	185.93	226.11	306.32
PSF	12.650	48.00	87.25	79.11	71.73	60.62
-----LVT 2---------FLOW	620. CFS------FAN DRAG 9420. LB---------					
DRIVER ACC	0.000	54	0.35	0.44	0.50	0.56
G,#2	0.159	0.60	-0.39	-0.45	-0.47	-0.49
TROOP ACC	0.000	57	0.37	0.46	0.52	0.64
G,#2	0.141	0.50	-0.26	-0.33	-0.41	-0.49
HOR ACC	-0.100	46	0.12	0.21		0.49
G,#2	0.084	0.25	-0.28	-0.35		-0.48
CUSH PRESS	67.627	19	87.86	95.79		109.03
PSF	5.446	24.00	53.75	47.46		43.80
TRUNK PRESS	110.765	8	137.96			143.27
PSF	6.997	40.00	93.29			90.80

DAVIDSON LABORATORY

TABLE 9-1

22-SEP-82

ACV BARGE TRAIN

(Continued)

RUN 123

SPEED	5.0 MPH	WAVE ENCOUNTERS	77
WEIGHT	30000. LB	SEA STATE	2
DRAG	1670. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 680. CFS------FAN DRAG 10660. LB---------						
DRIVER ACC	-0.011	49	0.37	0.47	0.56	0.65
G,#3	0.159	0.60	-0.39	-0.49	-0.56	-0.62
TROOP ACC	-0.002	63	0.33	0.40	0.45	0.54
G,#3	0.135	0.45	-0.27	-0.35	-0.42	-0.50
HOR ACC	0.074	31	0.33	0.42		0.54
G,#3	0.085	0.35	-0.16	-0.24		-0.53
CUSH PRESS	64.591	37	81.92	89.14		92.09
PSF	8.525	24.00	43.88	25.24		-33.29
TRUNK PRESS	115.439	10	137.44			142.11
PSF	6.667	36.00	96.92			92.48
-----LVT 4---------FLOW 630. CFS------FAN DRAG 9590. LB---------						
DRIVER ACC	-0.004	53	0.40	0.48	0.54	0.67
G,#4	0.162	0.60	-0.38	-0.46	-0.50	-0.55
TROOP ACC	-0.002	52	0.37	0.46	0.57	0.72
G,#4	0.147	0.50	-0.29	-0.37	-0.45	-0.51
HOR ACC	0.074	4	0.34			0.42
G,#4	0.070	0.40	-0.18			-0.20
CUSH PRESS	67.487	84	84.63	90.20	93.95	97.47
PSF	8.329	24.00	51.00	45.54	41.87	38.83
TRUNK PRESS	111.549	87	136.68	144.53	151.25	159.45
PSF	10.450	36.00	89.45	84.10	80.47	76.98

DAVIDSON LABORATORY

TABLE 9-2

22-SEP-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 124

SPEED 10.0 MPH
WEIGHT 30000. LB
DRAG 12160. LB

WAVE ENCOUNTERS 44
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	12.160	46	16.52	18.62		23.43
KIPS	2.964	3.42	7.97	6.13		4.77
-----LVT 1---------FLOW		620. CFS------FAN DRAG 4160. LB---------				
DRIVER ACC	-0.013	20	0.39	0.48		0.55
G,#1	0.182	0.60	-0.42	-0.52		-0.60
TROOP ACC	0.005	14	0.38	0.45		0.49
G,#1	0.153	0.60	-0.37	-0.45		-0.50
HOR ACC	-0.045	42	0.15	0.22		0.29
G,#1	0.095	0.25	-0.22	-0.29		-0.45
CUSH PRESS	56.456	58	100.61	123.47	143.57	174.19
PSF	19.082	32.00	33.03	22.44	16.30	8.49
TRUNK PRESS	98.740	33	146.61	177.81		301.48
PSF	14.374	48.00	72.52	63.19		58.19
-----LVT 2---------FLOW		630. CFS------FAN DRAG 4930. LB---------				
DRIVER ACC	0.006	35	0.42	0.53		0.66
G,#2	0.210	0.60	-0.47	-0.60		-0.66
TROOP ACC	0.000	40	0.40	0.52		0.67
G,#2	0.191	0.50	-0.35	-0.44		-0.56
HOR ACC	-0.049	42	0.13	0.18		0.22
G,#2	0.091	0.25	-0.23	-0.30		-0.44
CUSH PRESS	71.326	35	86.50	90.75		93.69
PSF	8.291	24.00	53.52	48.17		39.65
TRUNK PRESS	115.079	7	139.23			154.94
PSF	8.214	40.00	38.53			82.47

DAVIDSON LABORATORY

22-SEP-82

TABLE 9-2

ACV BARGE TRAIN

(Continued)

RUN 124

SPEED 10.0 MPH
WEIGHT 30000. LB
DRAG 12160. LB

WAVE ENCOUNTERS 44
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 650. CFS------FAN DRAG 5240. LB---------						
DRIVER ACC	0.009	33	0.45	0.57		0.79
G,#3	0.216	0.60	-0.44	-0.56		-0.64
TROOF ACC	-0.006	54	0.33	0.47	0.53	0.58
G,#3	0.185	0.45	-0.33	-0.44	-0.51	-0.55
HOR ACC	0.064	23	0.29	0.34		0.45
G,#3	0.097	0.35	-0.19	-0.27		-0.40
CUSH PRESS	72.574	17	88.50	97.58		103.93
PSF	7.661	24.00	44.69	26.26		-13.31
TRUNK PRESS	118.882	17	141.44	146.87		154.89
PSF	9.136	36.00	96.55	92.73		90.23
-----LVT 4---------FLOW 620. CFS------FAN DRAG 4890. LB---------						
DRIVER ACC	-0.013	3	0.37			0.46
G,#4	0.111	0.60	-0.72			-0.77
TROOF ACC	-0.042	31	0.38	0.50		0.76
G,#4	0.196	0.50	-0.38	-0.52		-0.71
HOR ACC	0.080	15	0.37	0.44		0.56
G,#4	0.100	0.40	-0.16	-0.22		-0.31
CUSH PRESS	[illegible]2.177	42	90.09	97.25		105.40
PSF	9.955	24.00	51.61	42.34		30.11
TRUNK PRESS	115.169	51	139.80	148.13	153.56	161.02
PSF	12.474	36.00	90.38	82.89	79.20	76.19

TABLE 9-3

DAVIDSON LABORATORY

ACV BARGE TRAIN

22-SEP-82

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 125

SPEED 12.5 MPH
WEIGHT 30000. LB
DRAG 14180. LB

WAVE ENCOUNTERS 38
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	14.177	49	20.30	23.43		27.19
KIPS	4.480	3.42	8.70	5.98		2.47
-----LVT 1---------FLOW 660. CFS------FAN DRAG 4200. LB---------						
DRIVER ACC	-0.010	22	0.67	0.84		1.17
G,#1	0.299	1.00	-0.64	-0.79		-0.90
TROOP ACC	0.008	27	0.63	0.81		1.24
G,#1	0.320	0.90	-0.58	-0.74		-1.00
HOR ACC	-0.128	56	0.14	0.27	0.38	0.53
G,#1	0.187	0.25	-0.43	-0.57	-0.67	-0.87
CUSH PRESS	68.313	16	91.43	95.89		98.91
PSF	7.466	32.00	49.04	43.92		38.01
TRUNK PRESS	116.676	57	161.08	178.79	200.04	258.64
PSF	19.096	48.00	86.01	73.76	63.58	58.19
-----LVT 2---------FLOW 630. CFS------FAN DRAG 4070. LB---------						
DRIVER ACC	0.011	42	0.62	0.86		1.08
G,#2	0.306	0.60	-0.50	-0.70		-0.82
TROOP ACC	0.000	41	0.48	0.64		0.95
G,#2	0.256	0.50	-0.40	-0.59		-0.78
HOR ACC	-0.045	54	0.21	0.34	0.43	0.46
G,#2	0.140	0.25	-0.26	-0.37	-0.45	-0.52
CUSH PRESS	75.864	50	95.84	104.01	111.97	124.70
PSF	11.819	24.[illegible]	56.61	49.84	46.30	44.12
TRUNK PRESS	119.228	12	147.79			166.60
PSF	9.500	40.00	94.13			78.30

TABLE 9-3

DAVIDSON LABORATORY ACV BARGE TRAIN 22-SEP-82

(Continued)

RUN 125

SPEED	12.5 MPH	WAVE ENCOUNTERS	38
WEIGHT	30000. LB	SEA STATE	2
DRAG	14180. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 650. CFS------FAN DRAG 4300. LB---------						
DRIVER ACC	0.013	34	0.52	0.71		1.12
G,#3	0.278	0.60	-0.50	-0.70		-0.88
TROOP ACC	-0.002	41	0.42	0.60		0.81
G,#3	0.242	0.45	-0.40	-0.54		-0.72
HOR ACC	0.082	40	0.42	0.60		0.77
G,#3	0.155	0.35	-0.21	-0.34		-0.63
CUSH PRESS	74.153	39	92.26	99.24		104.67
PSF	10.676	24.00	53.34	42.76		-13.31
TRUNK PRESS	121.087	14	143.29			150.38
PSF	9.855	36.00	96.83			89.47
-----LVT 4---------FLOW 640. CFS------FAN DRAG 4100. LB---------						
DRIVER ACC	-0.019	5	0.25			0.35
G,#4	0.148	0.60	-0.66			-0.82
TROOP ACC	-0.056	42	0.41	0.61		1.00
G,#4	0.244	0.50	-0.42	-0.56		-0.73
HOR ACC	0.100	21	0.46	0.62		0.74
G,#4	0.134	0.40	-0.16	-0.23		-0.28
CUSH PRESS	72.447	35	91.29	99.12		111.34
PSF	10.746	24.00	53.20	44.15		29.32
TRUNK PRESS	117.676	45	145.05	154.00		160.24
PSF	14.159	36.00	92.06	83.47		73.83

TABLE 9-4

DAVIDSON LABORATORY

ACV BARGE TRAIN

22-SEP-82

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 126

SPEED 15.0 MPH
WEIGHT 30000. LB
DRAG 12410. LB

WAVE ENCOUNTERS 38
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	12.415	39	17.47	20.25		22.92
TPS	3.561	3.42	7.43	5.00		3.46
-----LVT 1---------FLOW 660. CFS------FAN DRAG 3410. LB---------						
DRIVER ACC	-0.003	30	0.94	1.36		2.05
G,#1	0.410	1.00	-0.71	-0.94		-1.06
TROOP ACC	-0.011	37	0.71	0.99		1.60
G,#1	0.385	0.90	-0.63	-0.83		-1.02
HOR ACC	-0.124	67	0.20	0.40	0.61	0.76
G,#1	0.219	0.25	-0.42	-0.57	-0.63	-0.76
CUSH PRESS	66.220	57	99.81	117.46	132.92	163.86
PSF	19.588	32.00	34.25	19.70	12.73	11.07
TRUNK PRESS	114.178	69	167.19	200.59	227.35	245.71
PSF	26.267	48.00	76.51	59.21	49.19	37.99
-----LVT 2---------FLOW 620. CFS------FAN DRAG 3360. LB---------						
DRIVER ACC	0.011	43	0.62	0.88		1.49
G,#2	0.364	0.60	-0.53	-0.76		-1.01
TROOP ACC	0.003	38	0.48	0.67		0.81
G,#2	0.308	0.50	-0.54	-0.75		-0.99
HOR ACC	-0.015	70	0.25	0.42	0.64	0.77
G,#2	0.168	0.25	-0.25	-0.38	-0.47	-0.54
CUSH PRESS	78.084	47	99.02	109.69		119.90
PSF	13.463	24.00	54.83	41.35		-1.60
TRUNK PRESS	120.050	36	151.63	159.79		169.10
PSF	16.979	40.00	89.87	79.55		69.97

TABLE 9-4

DAVIDSON LABORATORY — ACV BARGE TRAIN — 22-SEP-82

(Continued)

RUN 126

SPEED	15.0 MPH	WAVE ENCOUNTERS	38
WEIGHT	30000. LB	SEA STATE	2
DRAG	12410. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 660. CFS------FAN DRAG 3610. LB---------						
DRIVER ACC	0.016	38	0.65	0.93		1.19
G,#3	0.395	0.60	-0.58	-0.85		-1.00
TROOP ACC	-0.007	43	0.50	0.71		1.00
G,#3	0.292	0.45	-0.42	-0.61		-0.79
HOR ACC	0.031	51	0.40	0.61	0.78	0.94
G,#3	0.199	0.35	-0.29	-0.47	-0.66	-0.85
CUSH PRESS	70.765	34	93.02	103.99		117.61
PSF	14.145	24.00	45.18	29.93		4.81
TRUNK PRESS	119.626	26	146.18	154.47		163.16
PSF	14.258	36.00	91.58	81.87		69.17
-----LVT 4---------FLOW 680. CFS------FAN DRAG 3610. LB---------						
DRIVER ACC	-0.126	21	0.35	0.52		0.58
G,#4	0.328	0.60	-0.76	-1.13		-1.35
TROOP ACC	-0.039	33	0.45	0.60		0.76
G,#4	0.268	0.50	-0.47	-0.74		-1.00
HOR ACC	0.081	25	0.47	0.61		0.79
G,#4	0.154	0.40	-0.18	-0.27		-0.32
CUSH PRESS	66.950	22	86.33	94.85		108.96
PSF	11.543	24.00	44.36	28.23		6.34
TRUNK PRESS	117.550	36	146.64	159.06		172.02
PSF	15.974	36.00	90.00	77.17		64.41

DAVIDSON LABORATORY | TABLE 9-5 | 28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 128 , 127

SPEED 20.0 MPH
WEIGHT 30000. LB
DRAG 12790. LB

WAVE ENCOUNTERS 43
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	12.792	43	16.55	19.02		21.38
KIPS	2.877	3.42	8.62	6.50		4.72
-----LVT 1---------FLOW		CFS------FAN DRAG			LB---------	
DRIVER ACC	-0.009	46	1.37	2.21		3.47
G,#1	0.597	1.00	-0.75	-1.03		-1.18
TROOF ACC	0.016	55	0.84	1.13	1.36	1.73
G,#1	0.412	0.90	-0.56	-0.76	-0.85	-0.92
HOR ACC	-0.085	71	0.23	0.44	0.58	0.75
G,#1	0.207	0.25	-0.36	-0.50	-0.63	-0.80
CUSH PRESS	75.497	86	121.38	150.33	180.51	208.88
PSF	27.382	32.00	44.36	25.94	12.10	4.06
TRUNK PRESS						
PSF	39.424					
-----LVT 2---------FLOW		630. CFS------FAN DRAG		2430. LB---------		
DRIVER ACC	0.014	57	0.90	1.48	2.04	2.43
G,#2	0.524	0.60	-0.59	-0.94	-1.09	-1.21
TROOF ACC	0.002	61	0.57	0.82	0.98	1.26
G,#2	0.324	0.50	-0.41	-0.62	-0.76	-1.00
HOR ACC	-0.051	74	0.22	0.39	0.59	0.87
G,#2	0.170	0.25	-0.31	-0.45	-0.55	-0.67
CUSH PRESS	68.258	66	116.57	158.10	196.37	235.65
PSF	26.972	24.00	38.68	17.40	2.79	-10.23
TRUNK PRESS	112.537	50	153.07	171.50	189.25	195.75
PSF	22.161	40.00	81.20	68.79	59.48	49.15

DAVIDSON LABORATORY

TABLE 9-5
ACV BARGE TRAIN
(Continued)

28-OCT-82

RUN 128 , 127

SPEED 20.0 MPH
WEIGHT 30000. LB
DRAG 12790. LB

WAVE ENCOUNTERS 43
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 660. CFS------FAN DRAG 2700. LB---------						
DRIVER ACC	0.016	49	0.65	0.95		1.58
G,#3	0.401	0.60	-0.50	-0.74		-0.86
TROOP ACC	-0.004	46	0.48	0.69		1.02
G,#3	0.275	0.45	-0.41	-0.54		-0.77
HOR ACC	0.044	47	0.37	0.53		0.92
G,#3	0.187	0.35	-0.28	-0.47		-1.06
CUSH PRESS	70.481	53	99.46	118.35	144.43	224.50
PSF	16.619	24.00	46.18	25.05	3.82	-27.37
TRUNK PRESS	119.380	46	151.36	162.45		182.71
PSF	18.811	36.00	92.02	80.36		56.39
-----LVT 4---------FLOW 630. CFS------FAN DRAG 2520. LB---------						
DRIVER ACC	-0.068	19	0.50	0.70		1.00
G,#4	0.209	0.60				
TROOP ACC	-0.035	45	0.48	0.73		1.06
G,#4	0.266	0.50	-0.40	-0.60		-0.85
HOR ACC	0.059	24	0.46	0.70		1.18
G,#4	0.162	0.40	-0.21	-0.34		-0.49
CUSH PRESS	72.303	42	98.28	109.67		121.25
PSF	18.631	24.00	45.13	25.39		5.55
TRUNK PRESS	116.813	49	153.94	174.00		222.29
PSF	20.359	36.00	87.92	76.28		63.62

DAVIDSON LABORATORY TABLE 9-6 28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 137 , 136

SPEED 25.0 MPH WAVE ENCOUNTERS 37
WEIGHT 30000. LB SEA STATE 2
DRAG 13300. LB LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	13.298	34	18.30	21.98		28.50
KIPS	3.427	3.42	8.74	6.77		4.17
-----LVT 1---------FLOW	700. CFS------FAN DRAG	2320. LB---------				
DRIVER ACC	0.006	54	1.61	2.34	2.82	3.14
G,#1	0.748	1.00	-0.74	-1.10	-1.25	-1.39
TROOF ACC						
G,#1						
HOR ACC	-0.073	63	0.27	0.47	0.62	0.77
G,#1	0.228	0.25	-0.36	-0.54	-0.73	-0.87
CUSH PRESS	67.883	76	128.47	158.75	180.98	195.23
PSF	36.304	32.00	30.67	6.83	-4.11	-45.76
TRUNK PRESS	121.810	76	205.27	253.32	294.71	321.68
PSF	43.883	48.00	79.00	59.34	47.28	29.10
-----LVT 2---------FLOW	670. CFS------FAN DRAG	2070. LB---------				
DRIVER ACC	0.014	53	1.00	1.49	1.83	2.09
G,#2	0.583	0.60	-0.62	-0.98	-1.11	-1.23
TROOP ACC	0.002	52	0.73	1.00	1.14	1.33
G,#2	0.438	0.50	-0.47	-0.79	-0.95	-1.03
HOR ACC	-0.054	63	0.21	0.39	0.52	0.96
G,#2	0.197	0.25	-0.35	-0.52	-0.70	-0.99
CUSH PRESS	63.109	66	106.91	132.17	149.09	161.47
PSF	30.007	24.00	30.09	11.54	1.23	-15.35
TRUNK PRESS	112.996	53	157.31	176.27	184.78	191.59
PSF	26.575	40.00	79.94	65.57	58.45	50.81

DAVIDSON LABORATORY

TABLE 9-6

ACV BARGE TRAIN

(Continued)

28-OCT-82

RUN 137 , 136

SPEED	25.0 MPH	WAVE ENCOUNTERS	37
WEIGHT	30000. LB	SEA STATE	2
DRAG	13300. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 730. CFS------FAN DRAG 2400. LB---------						
DRIVER ACC	0.017	46	0.86	1.26		1.73
G,#3	0.485	0.60	-0.50	-0.79		-0.94
TROOP ACC	0.000	45	0.59	0.91		1.45
G,#3	0.344	0.45	-0.44	-0.64		-0.79
HOR ACC	0.033	45	0.39	0.63		1.15
G,#3	0.206	0.35	-0.29	-0.45		-0.73
CUSH PRESS	60.594	52	91.62	113.30	123.66	132.04
PSF	27.419	24.00	25.36	-3.18	-23.12	-39.57
TRUNK PRESS	120.151	48	162.88	179.18		187.22
PSF	25.833	36.00	87.80	69.83		54.14
-----LVT 4---------FLOW 660. CFS------FAN DRAG 2090. LB---------						
DRIVER ACC	0.011	46	0.81	1.19		1.98
G,#4	0.461	0.60	-0.53	-0.76		-0.92
TROOP ACC	-0.004	41	0.57	0.90		1.19
G,#4	0.320	0.50	-0.42	-0.60		-0.82
HOR ACC	0.055	24	0.45	0.61		0.84
G,#4	0.180	0.40	-0.24	-0.35		-0.44
CUSH PRESS	66.661	48	97.14	111.99		131.15
PSF	22.264	24.00	38.53	19.34		-3.17
TRUNK PRESS	115.558	53	160.31	183.19	204.61	221.50
PSF	26.341	36.00	83.11	70.39	61.27	51.06

TABLE 9-7

DAVIDSON LABORATORY — ACV BARGE TRAIN — 28-OCT-82

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 131 , 129

SPEED 30.0 MPH — WAVE ENCOUNTERS 32
WEIGHT 30000. LB — SEA STATE 2
DRAG 14550. LB — LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	14.546	28	21.34	25.96		31.96
KIPS	5.330	3.42	8.29	5.59		1.01
-----LVT 1---------FLOW 680. CFS------FAN DRAG 1790. LB---------						
DRIVER ACC	-0.001	49	1.54	2.28		3.56
G,#1	0.770	1.00	-0.68	-1.06		-1.37
TROOF ACC	0.014	46	1.04	1.38		1.98
G,#1	0.556	0.90	-0.63	-0.93		-1.17
HOR ACC	-0.060	56	0.28	0.46	0.63	0.81
G,#1	0.253	0.25	-0.38	-0.58	-0.66	-0.79
CUSH PRESS	62.989	60	127.85	155.70	175.92	210.36
PSF	36.932	32.00	24.92	2.51	-3.81	-9.60
TRUNK PRESS	114.944	66	207.01	260.40	297.78	359.67
PSF	47.472	48.00	72.42	45.26	30.25	19.40
-----LVT 2---------FLOW 560. CFS------FAN DRAG 1340. LB---------						
DRIVER ACC	0.005	47	1.09	1.72		2.91
G,#2	0.647	0.60	-0.61	-1.01		-1.20
TROOF ACC	-0.013	46	0.85	1.29		2.05
G,#2	0.524	0.50	-0.58	-1.01		-1.39
HOR ACC	-0.023	54	0.31	0.51	0.61	0.67
G,#2	0.243	0.25	-0.37	-0.55	-0.68	-0.75
CUSH PRESS	71.455	60	121.29	156.67	182.89	205.28
PSF	33.652	24.00	40.07	21.06	7.67	-15.35
TRUNK PRESS	106.016	46	154.46	175.50		196.58
PSF	29.630	40.00	71.13	52.74		28.32

TABLE 9-7
ACV BARGE TRAIN
(Continued)

DAVIDSON LABORATORY

28-OCT-82

RUN 131 , 129

SPEED 30.0 MPH
WEIGHT 30000. LB
DRAG 14550. LB

WAVE ENCOUNTERS 32
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 710. CFS------FAN DRAG 1890. LB---------						
DRIVER ACC	0.010	45	1.06	1.66		2.37
G,#3	0.605	0.60	-0.61	-0.99		-1.15
TROOP ACC	-0.007	53	0.64	0.97	1.13	1.19
G,#3	0.397	0.45	-0.44	-0.73	-0.90	-1.15
HOR ACC	0.007	45	0.41	0.64		0.94
G,#3	0.257	0.35	-0.39	-0.64		-1.23
CUSH PRESS	59.943	61	97.99	122.62	140.97	163.48
PSF	30.793	24.00	23.04	1.34	-11.41	-33.66
TRUNK PRESS	116.347	48	164.41	188.25		223.31
PSF	30.178	36.00	81.95	60.39		44.36
-----LVT 4---------FLOW 570. CFS------FAN DRAG 1500. LB---------						
DRIVER ACC	0.150	54	0.93	1.31	1.56	1.85
G,#4	0.581	0.60	-0.48	-0.76	-0.89	-0.96
TROOP ACC	0.000	23	0.56	0.81		0.96
G,#4	0.249	0.50	-0.40	-0.57		-0.77
HOR ACC	0.044	24	0.56	0.85		1.27
G,#4	0.234	0.40	-0.29	-0.41		-0.63
CUSH PRESS	79.398	45	112.62	129.01		137.89
PSF	22.022	24.00	53.95	33.36		14.26
TRUNK PRESS	115.717	47	170.51	200.83		248.99
PSF	31.062	36.00	81.67	65.54		33.78

TABLE 9-8

DAVIDSON LABORATORY ACV BARGE TRAIN 28-OCT-82

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 135 , 134

SPEED	35.0 MPH	WAVE ENCOUNTERS	33
WEIGHT	30000. LB	SEA STATE	2
DRAG	16470. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
DRAG	16.474	24	23.53	29.65		32.57
KIPS	5.683	3.42	9.59	6.70		3.84
-----LVT 1---------FLOW 528. CFS------FAN DRAG 1104. LB---------						
DRIVER ACC	-0.006	39	1.93	2.86		3.90
G,#1	0.844	1.00	-0.79	-1.13		-1.42
TROOP ACC	-0.006	23	1.12	1.45		1.57
G,#1	0.548	0.90	-0.59	-0.85		-1.17
HOR ACC	-0.048	50	0.40	0.70	0.98	1.27
G,#1	0.307	0.25	-0.42	-0.61	-0.79	-1.05
CUSH PRESS	76.421	59	138.43	174.19	194.37	207.78
PSF	36.828	32.00	40.46	15.63	6.83	-2.58
TRUNK PRESS	107.318	33	197.92	262.39		345.12
PSF	53.431	48.00	58.88	34.53		-4.04
-----LVT 2---------FLOW 640. CFS------FAN DRAG 1370. LB---------						
DRIVER ACC	0.012	42	1.23	2.12		4.14
G,#2	0.660	0.60	-0.62	-0.96		-1.17
TROOP ACC	-0.003	40	0.91	1.37		2.70
G,#2	0.485	0.50	-0.50	-0.84		-1.24
HOR ACC	-0.048	51	0.35	0.60	0.77	1.33
G,#2	0.269	0.25	-0.40	-0.61	-0.80	-1.08
CUSH PRESS	65.135	52	118.28	161.26	194.62	242.05
PSF	33.909	24.00	33.94	5.77	-4.26	-9.59
TRUNK PRESS	110.154	41	162.55	187.84		219.91
PSF	30.233	40.00	73.57	59.20		41.65

DAVIDSON LABORATORY

TABLE 9-8
ACV BARGE TRAIN
(Continued)

28-OCT-82

RUN 135 , 134

SPEED	35.0 MPH	WAVE ENCOUNTERS	33
WEIGHT	30000. LB	SEA STATE	2
DRAG	16470. LB	LCG	110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 690. CFS------FAN DRAG 1590. LB---------						
DRIVER ACC	0.004	45	1.02	1.61		2.36
G,#3	0.604	0.60	-0.65	-1.00		-1.35
TROOP ACC	-0.003	46	0.68	1.04		1.51
G,#3	0.397	0.45	-0.46	-0.69		-1.03
HOR ACC	0.048	42	0.48	0.79	0.94	1.17
G,#3	0.278	0.35	-0.36	-0.62	-0.83	-1.13
CUSH PRESS	65.187	49	107.66	127.56		156.45
PSF	32.970	24.00	24.52	-0.63		-14.79
TRUNK PRESS	118.209	50	163.41	186.69	199.40	212.78
PSF	28.545	36.00	84.96	67.98	54.59	45.11
-----LVT 4---------FLOW 610. CFS------FAN DRAG 1340. LB---------						
DRIVER ACC	0.013	41	1.15	1.69		2.73
G,#4	0.655	0.60	-0.60	-1.05		-1.27
TROOP ACC	-0.021	39	0.81	1.20		1.65
G,#4	0.497	0.50	-0.54	-0.87		-1.11
HOR ACC	0.027	23	0.62	0.87		1.22
G,#4	0.298	0.40	-0.40	-0.61		-0.96
CUSH PRESS	72.754	44	112.36	138.37		201.29
PSF	27.685	24.00	41.26	22.93		10.70
TRUNK PRESS	113.606	51	173.11	203.76	227.13	248.99
PSF	37.130	36.00	79.15	55.95	43.72	35.35

DAVIDSON LABORATORY — TABLE 9-9 — 28-OCT-82

ACV BARGE TRAIN

FOUR UNITS, LCAC TOW, 13.3 FT SPACING, TRACKS DOWN

RUN 133 , 132

SPEED 44.8 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 28
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 1---------FLOW 620. CFS------FAN DRAG 1090. LB---------						
DRIVER ACC	0.013	33	2.22	3.23		4.81
G,#1	1.035	1.00	-0.90	-1.30		-1.64
TROOP ACC	0.066	33	1.32	1.93		2.70
G,#1	0.597	0.90	-0.56	-0.83		-1.01
HOR ACC	-0.038	41	0.36	0.61		0.82
G,#1	0.266	0.25	-0.39	-0.59		-0.82
CUSH PRESS	73.650	45	151.45	201.06		264.98
PSF	47.516	32.00	32.30	-6.13		-47.98
TRUNK PRESS	115.794	48	229.64	314.91		452.62
PSF	65.971	48.00	59.64	28.04		-3.23
-----LVT 2---------FLOW 586. CFS------FAN DRAG 951. LB---------						
DRIVER ACC	0.022	34	1.75	2.88		3.82
G,#2	0.863	0.60	-0.71	-1.11		-1.33
TROOP ACC	0.006	36	1.02	1.76		3.00
G,#2	0.519	0.50	-0.52	-0.78		-0.98
HOR ACC	-0.018	44	0.33	0.55		0.86
G,#2	0.261	0.25	-0.37	-0.55		-0.90
CUSH PRESS	68.658	24	139.26	195.04		287.13
PSF	44.052	24.00	38.40	9.87		-10.23
TRUNK PRESS	106.681	31	175.68	203.32		218.24
PSF	39.560	40.00	63.47	45.51		31.65

DAVIDSON LABORATORY

TABLE 9-9

ACV BARGE TRAIN

(Continued)

28-OCT-82

RUN 133 , 132

SPEED 44.8 MPH
WEIGHT 30000. LB
DRAG LB

WAVE ENCOUNTERS 28
SEA STATE 2
LCG 110.0 IN

	MEAN/RMS	OSC/BUFF	AVG	1/3	1/10	EXTREME
-----LVT 3---------FLOW 65 CFS------FAN DRAG 1140. LB---------						
DRIVER ACC	0.021	39	1.05	1.66		3.07
G,#3	0.598	0.60	-0.59	-0.92		-1.11
TROOF ACC	-0.013	38	0.77	1.18		2.35
G,#3	0.450	0.45	-0.42	-0.69		-0.93
HOR ACC	0.025	29	0.42	0.61		0.79
G,#3	0.225	0.35	-0.33	-0.50		-0.72
CUSH PRESS	67.001	37	108.29	129.22		144.98
PSF	34.533	24.00	24.47	-0.80		-21.82
TRUNK PRESS	114.363	43	161.76	185.61		213.53
PSF	32.453	36.00	77.20	57.09		41.35
-----LVT 4---------FLOW 600. CFS------FAN DRAG 1030. LB---------						
DRIVER ACC	0.000	38	1.03	1.59		2.56
G,#4	0.652	0.60	-0.55	-1.01		-1.23
TROOF ACC	0.003	34	0.67	1.07		1.45
G,#4	0.397	0.50	-0.43	-0.64		-0.78
HOR ACC	0.040	19	0.46	0.65		0.86
G,#4	0.210	0.40	-0.28	-0.45		-0.64
CUSH PRESS	72.19[illegible]	32	108.06	128.78		165.23
PSF	27.226	24.00	40.84	19.60		7.92
TRUNK PRESS	112.606	41	171.08	204.45		255.28
PSF	37.301	36.00	77.70	52.29		29.85

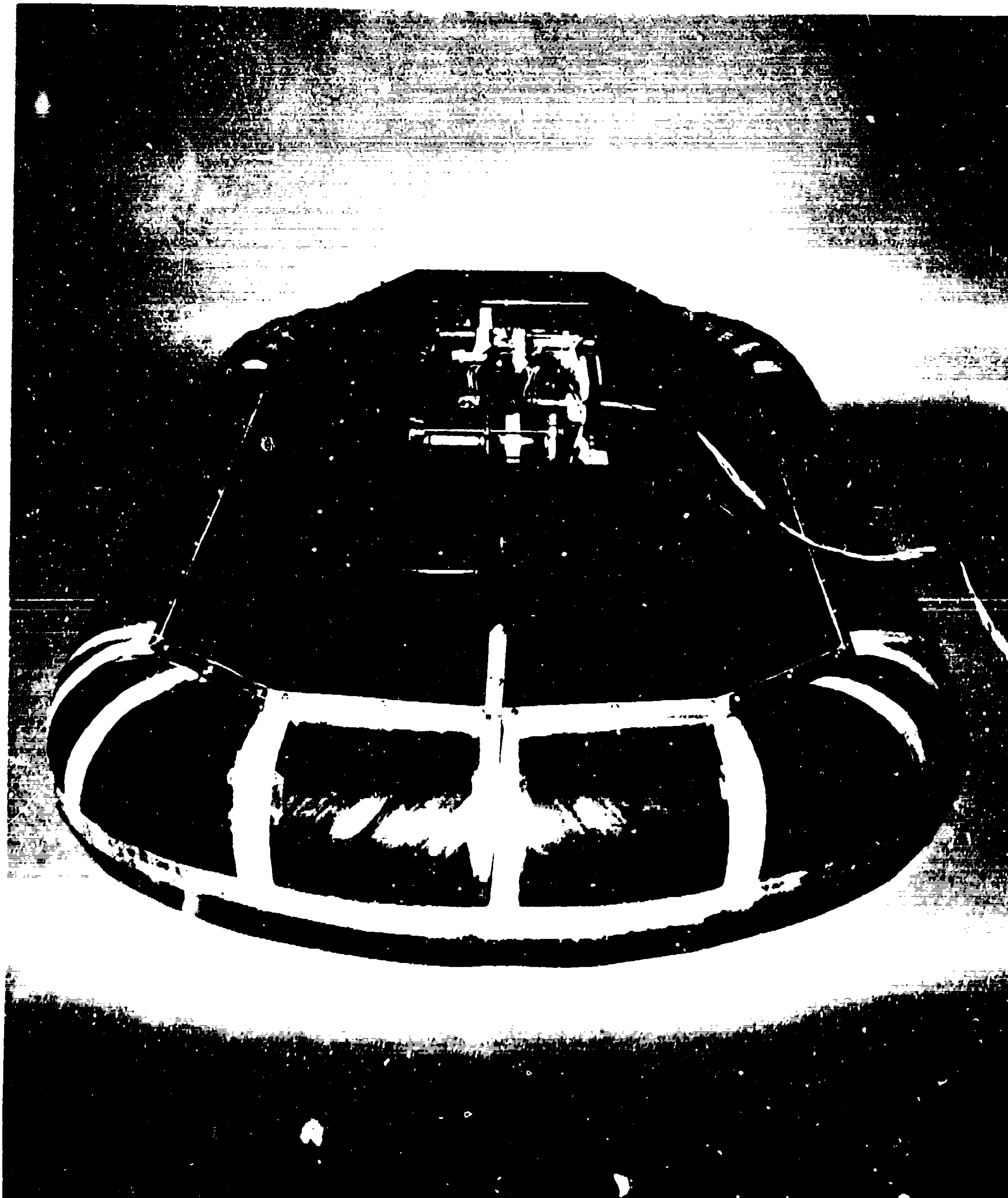
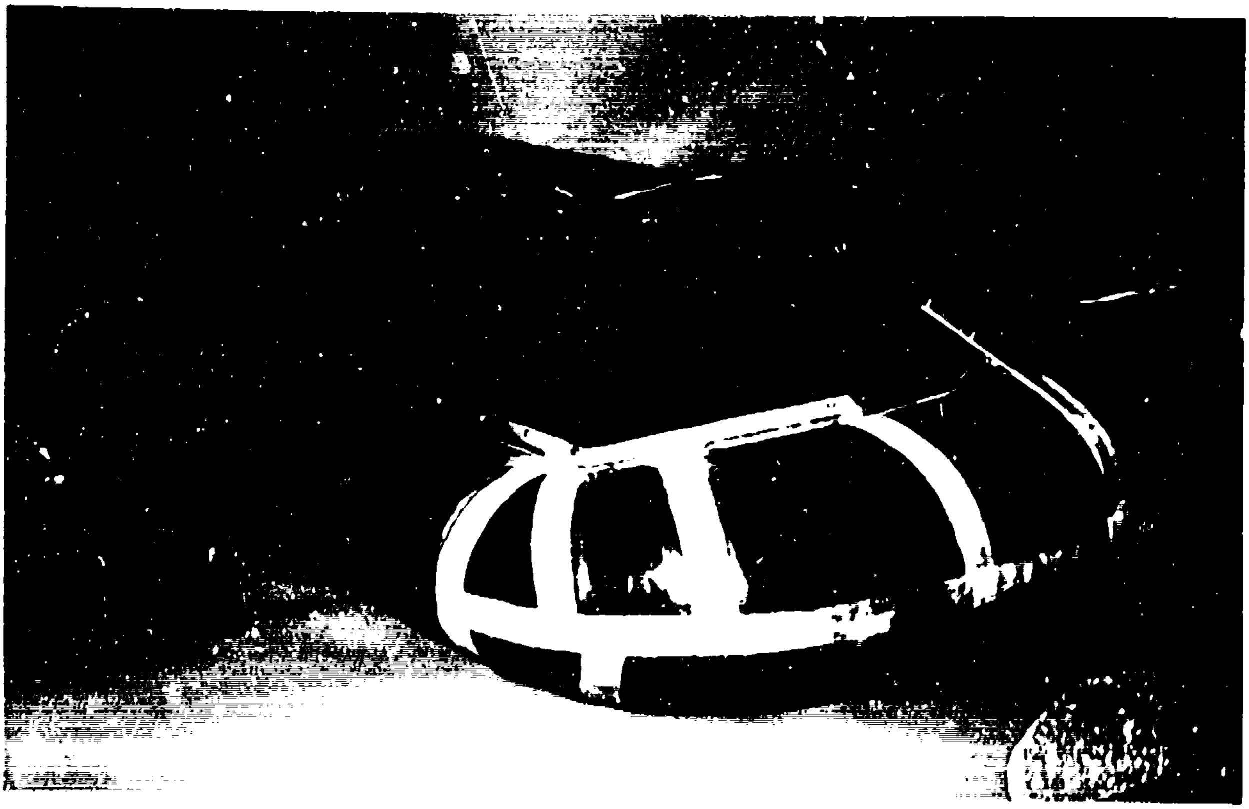
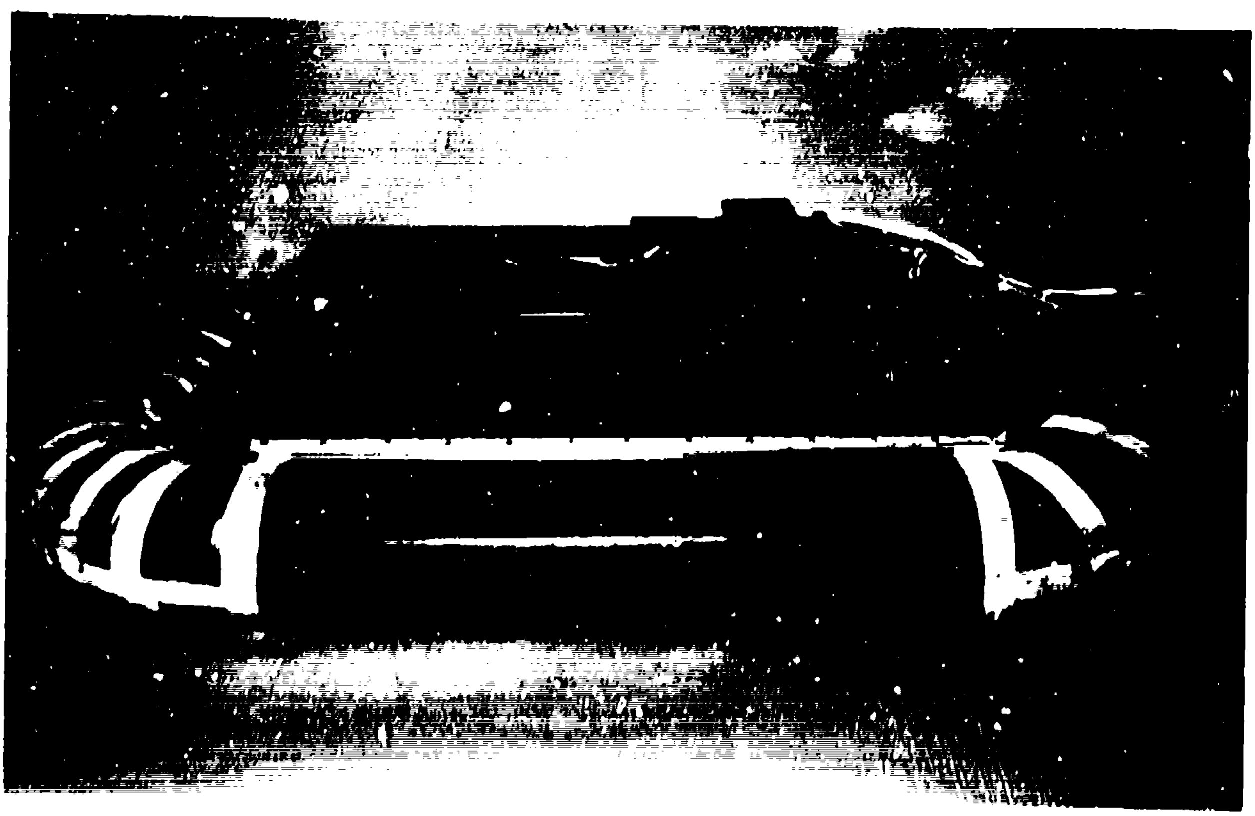


FIGURE 1 - BOW VIEW OF ACV MODEL ON CUSHION



BOW QUARTER VIEW



SIDE VIEW

FIGURE 2 - ACV MODEL ON CUSHION

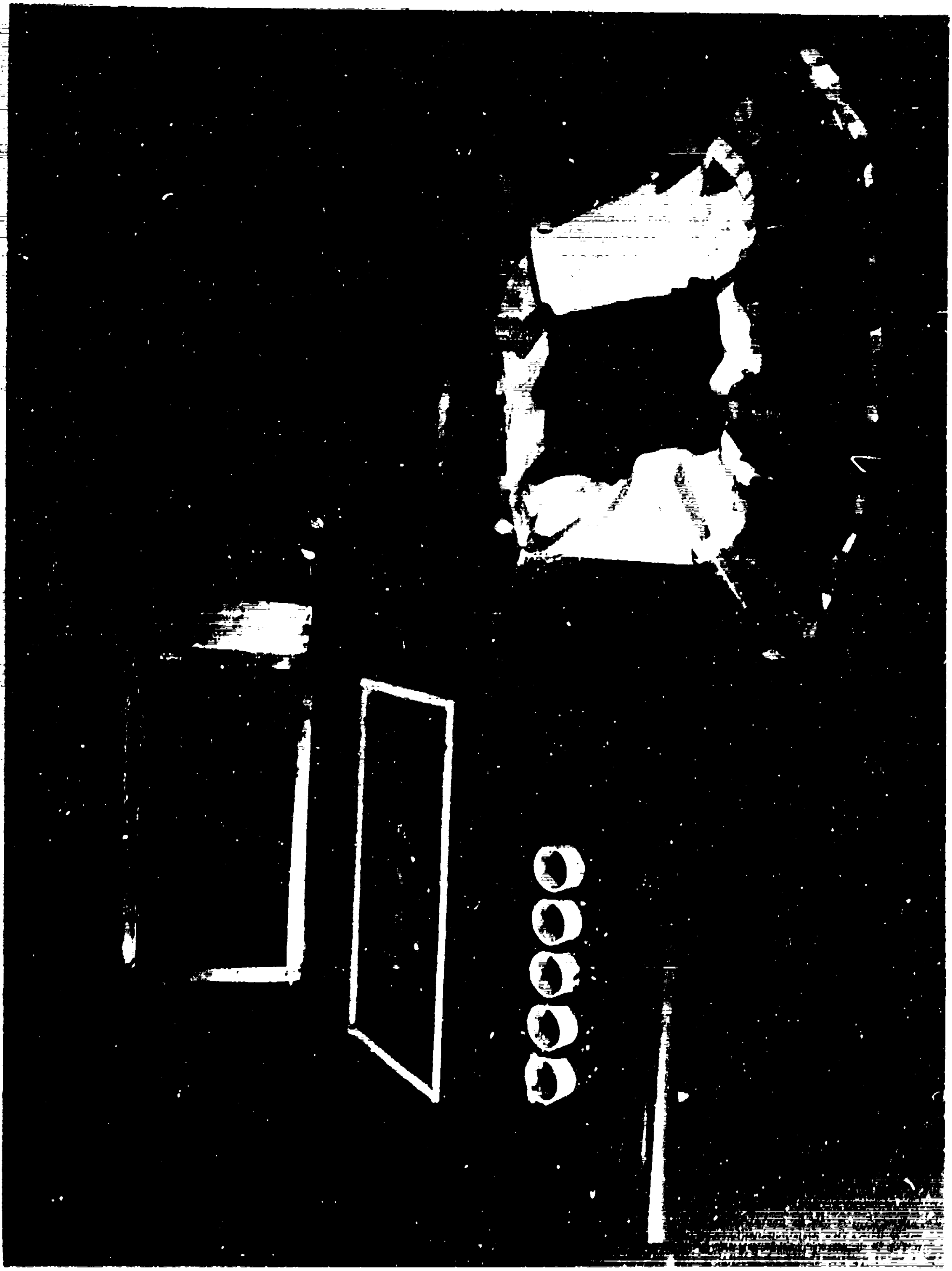
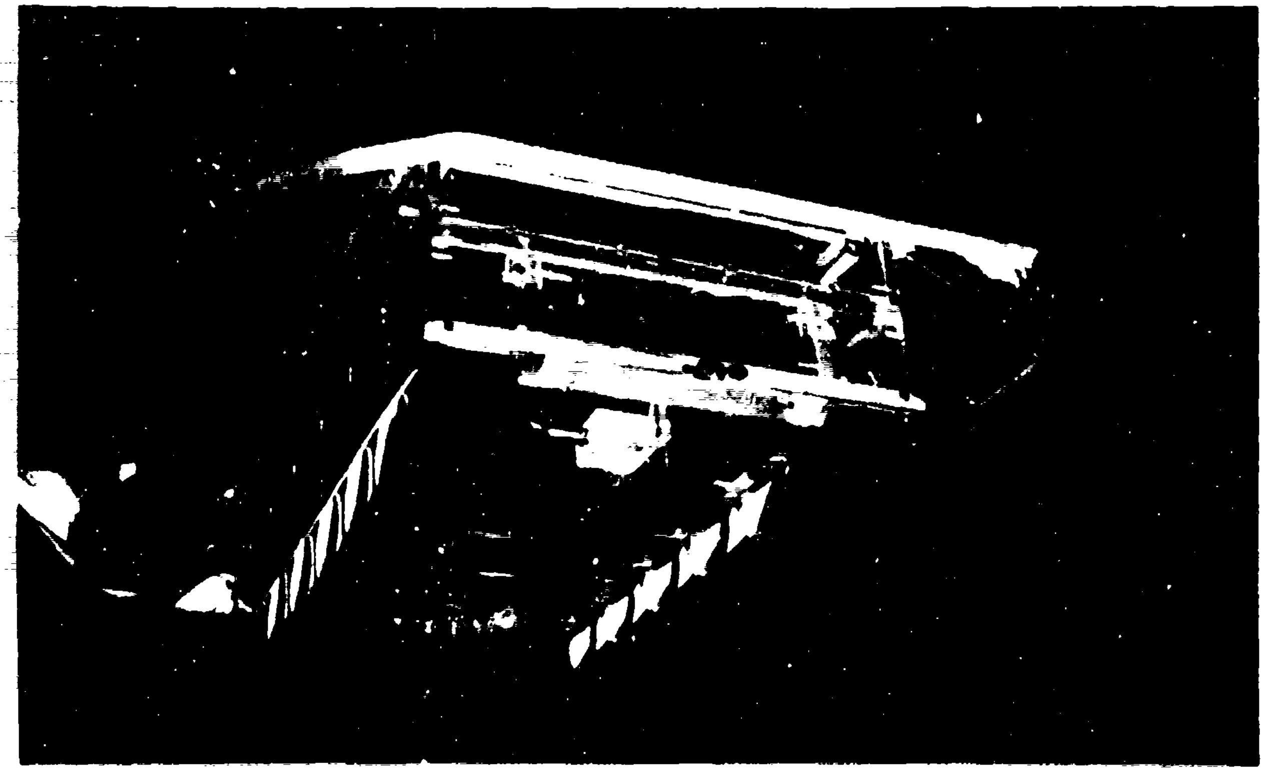
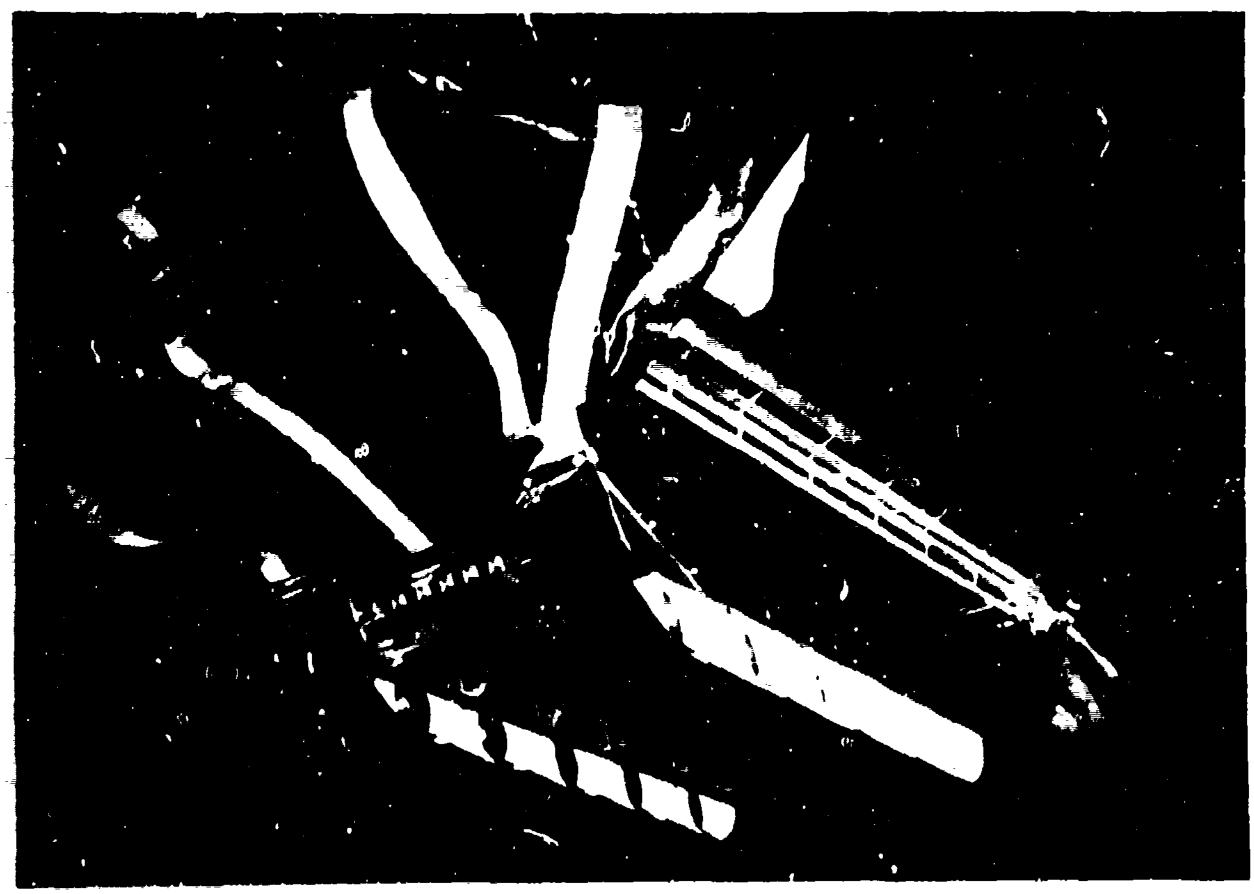


FIGURE 3 – COMPONENTS OF THE ACV MODEL



STERN VIEW



BOW VIEW

FIGURE 4 - UNDERSIDE OF ACV MODEL HULL

FIGURE 5 - A FOUR UNIT TRAIN IN SEA STATE 2 AT 12.5 MPH

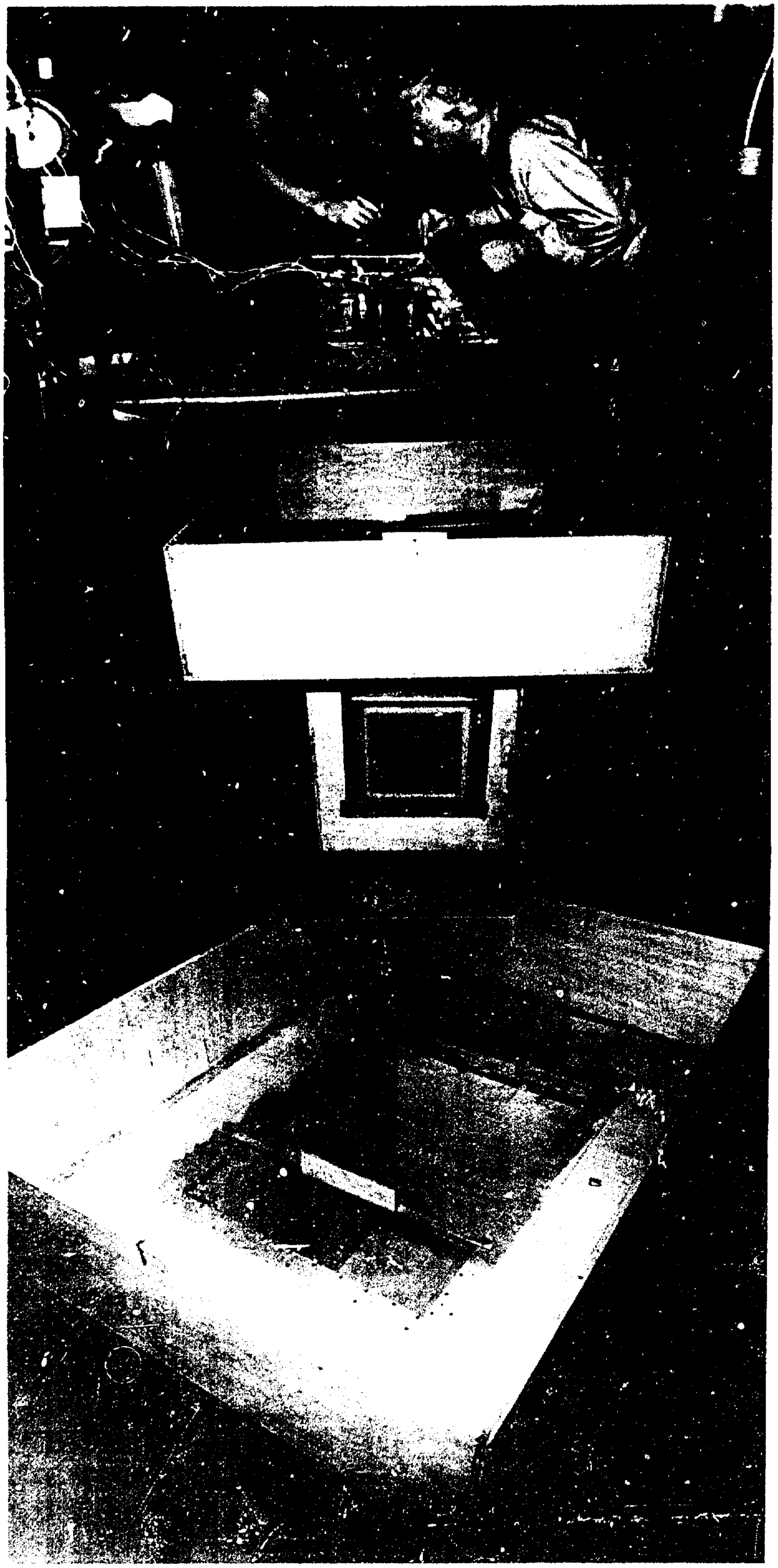


FIGURE [illegible] FAN CALIBRATION SETUP

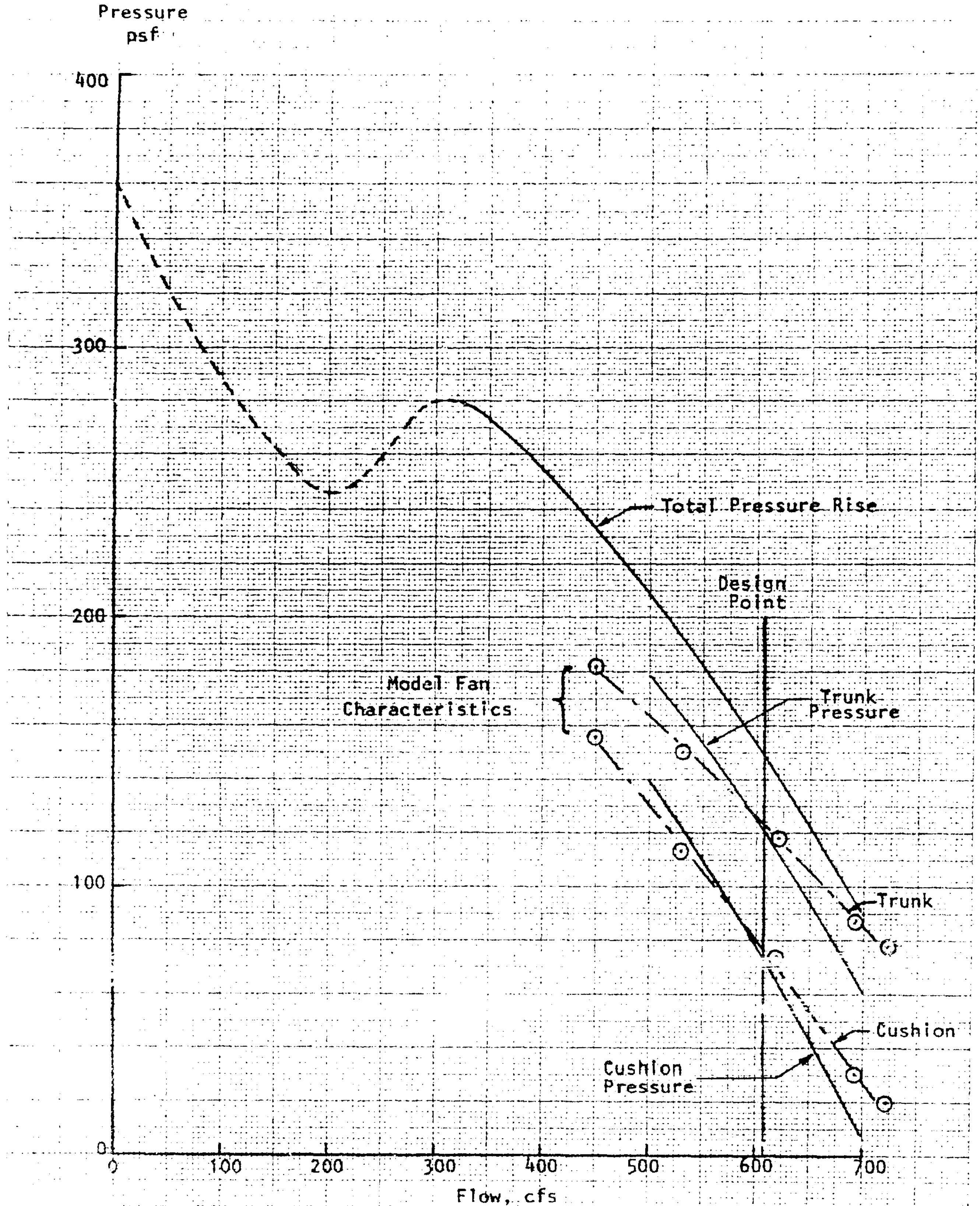


FIGURE 7 ACV FAN CHARACTERISTICS

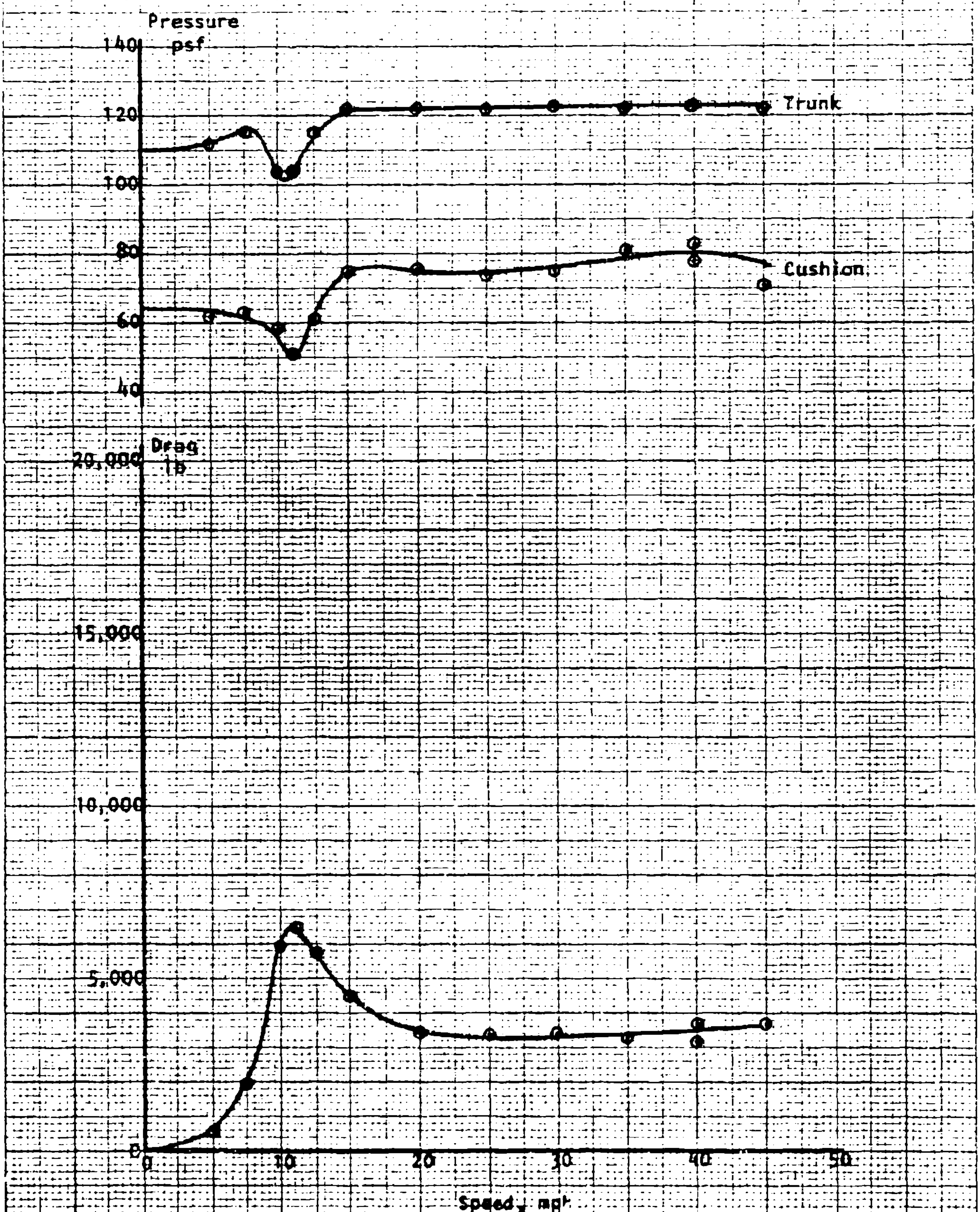


FIGURE 8 SINGLE ACV IN CALM WATER, TRACKS DOWN

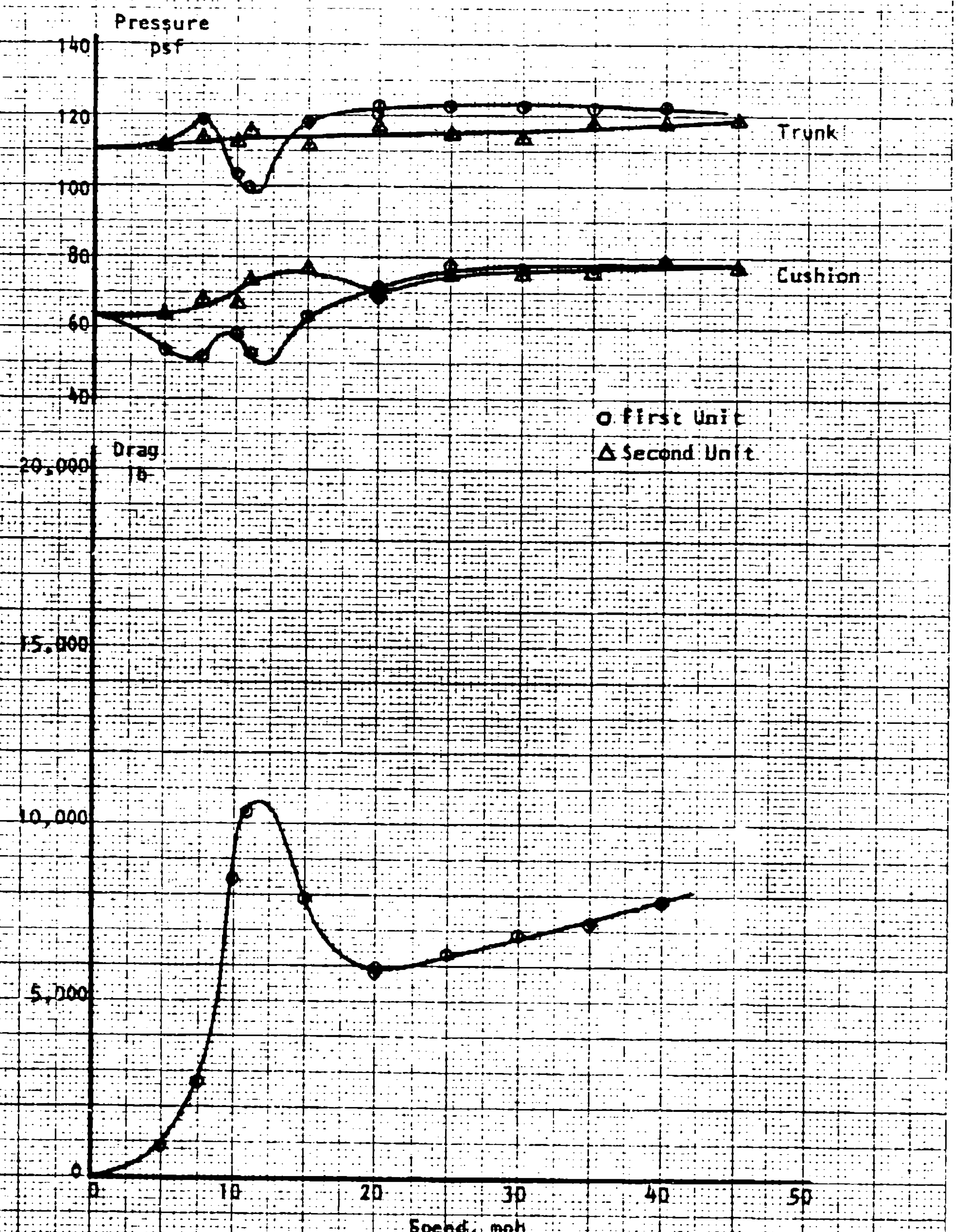


FIGURE 9 TWO UNIT ACV TRAIN IN CALM WATER

HELICOPTER TOW, 22.7 FT SPACING, TRACKS DOWN

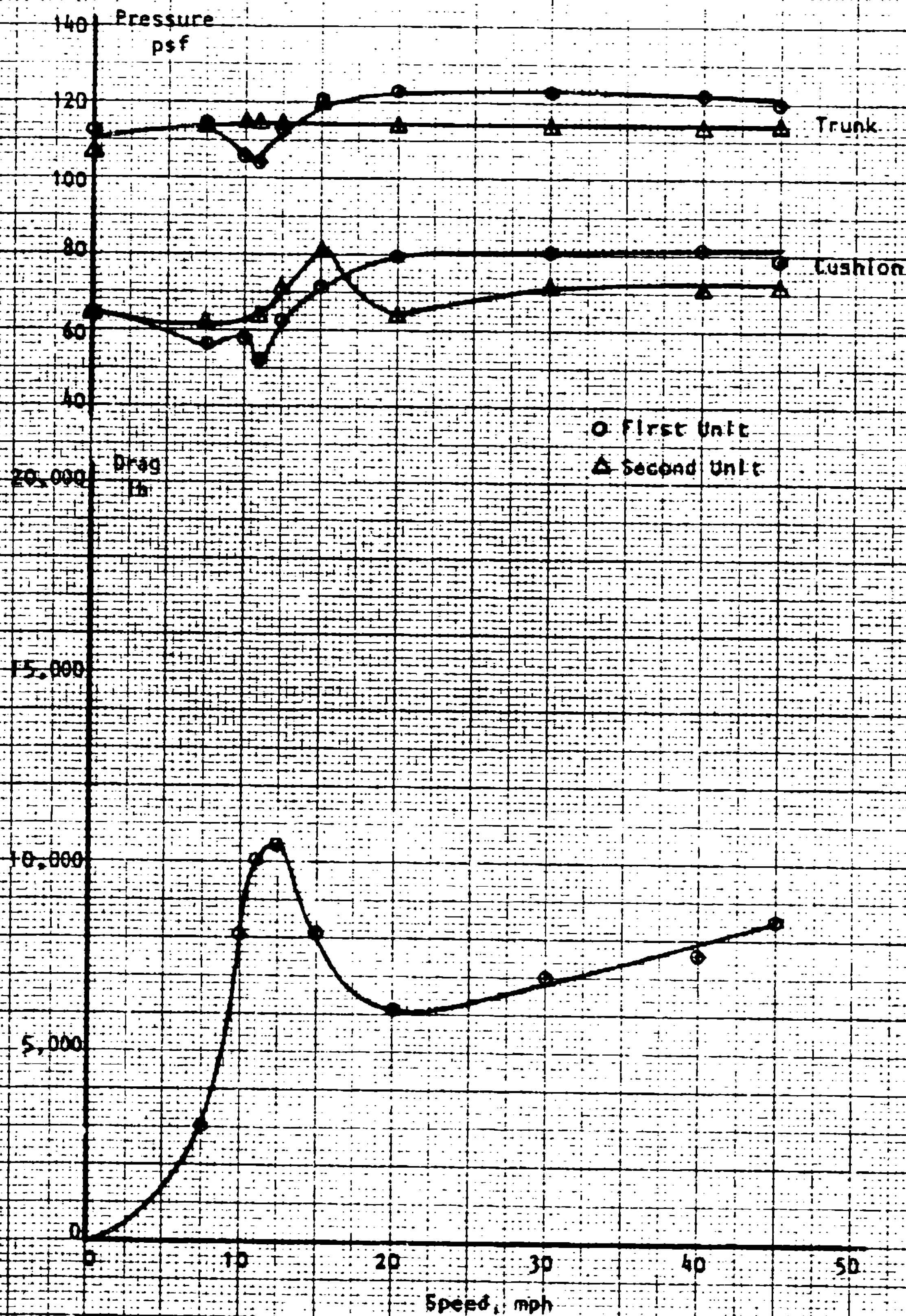


FIGURE 10 TWO UNIT ACV TRAIN IN CALM WATER
LCAC TOW, 22.7 FT SPACING, TRACKS DOWN

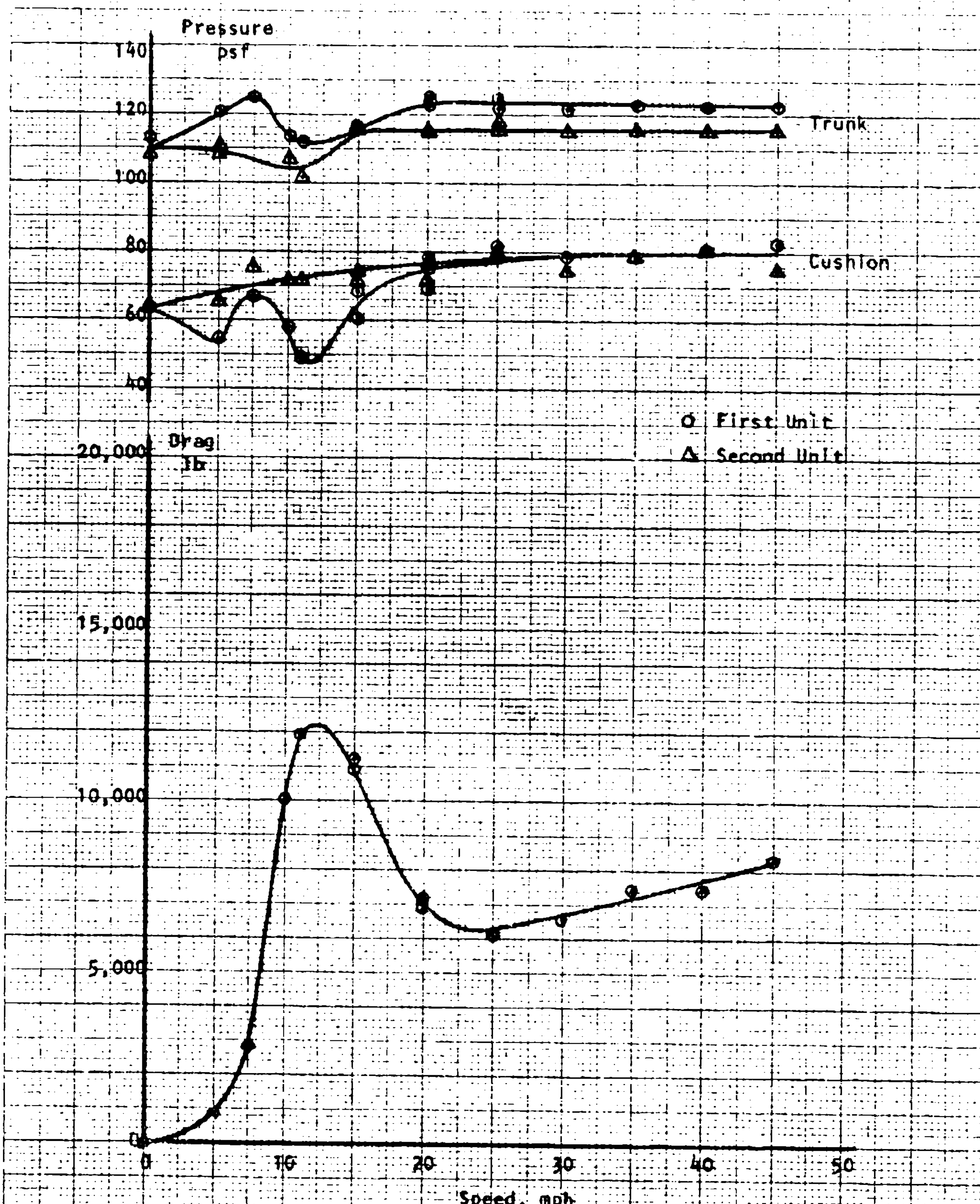


FIGURE 11 TWO UNIT ACV TRAIN IN CALM WATER
HELICOPTER TOW, 42.7 FT SPACING, TRACKS DOWN

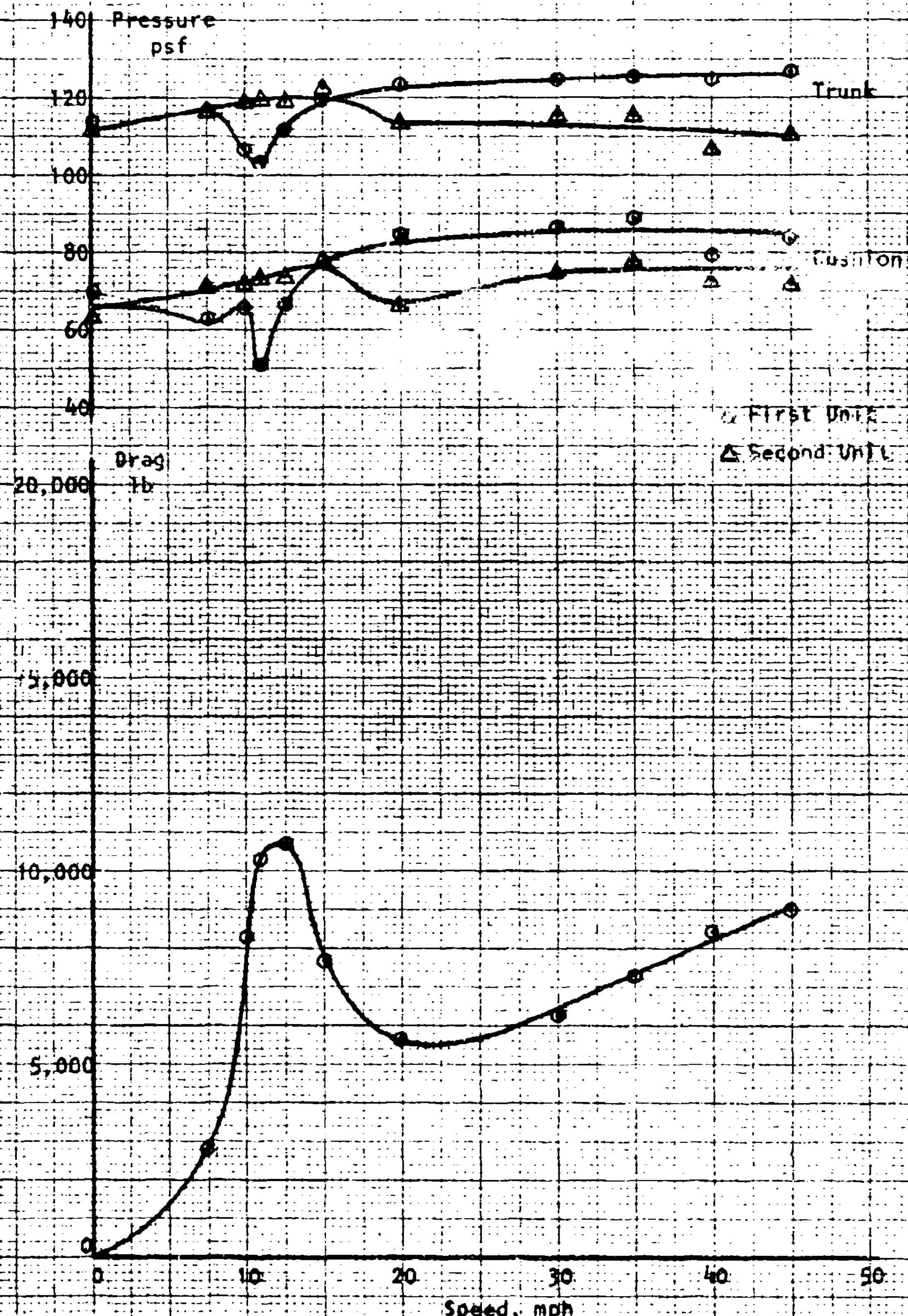


FIGURE 12 TWO UNIT ACV TRAIN IN CALM WATER
LCAC TOW, 22.7 FT SPACING, TRACKS UP

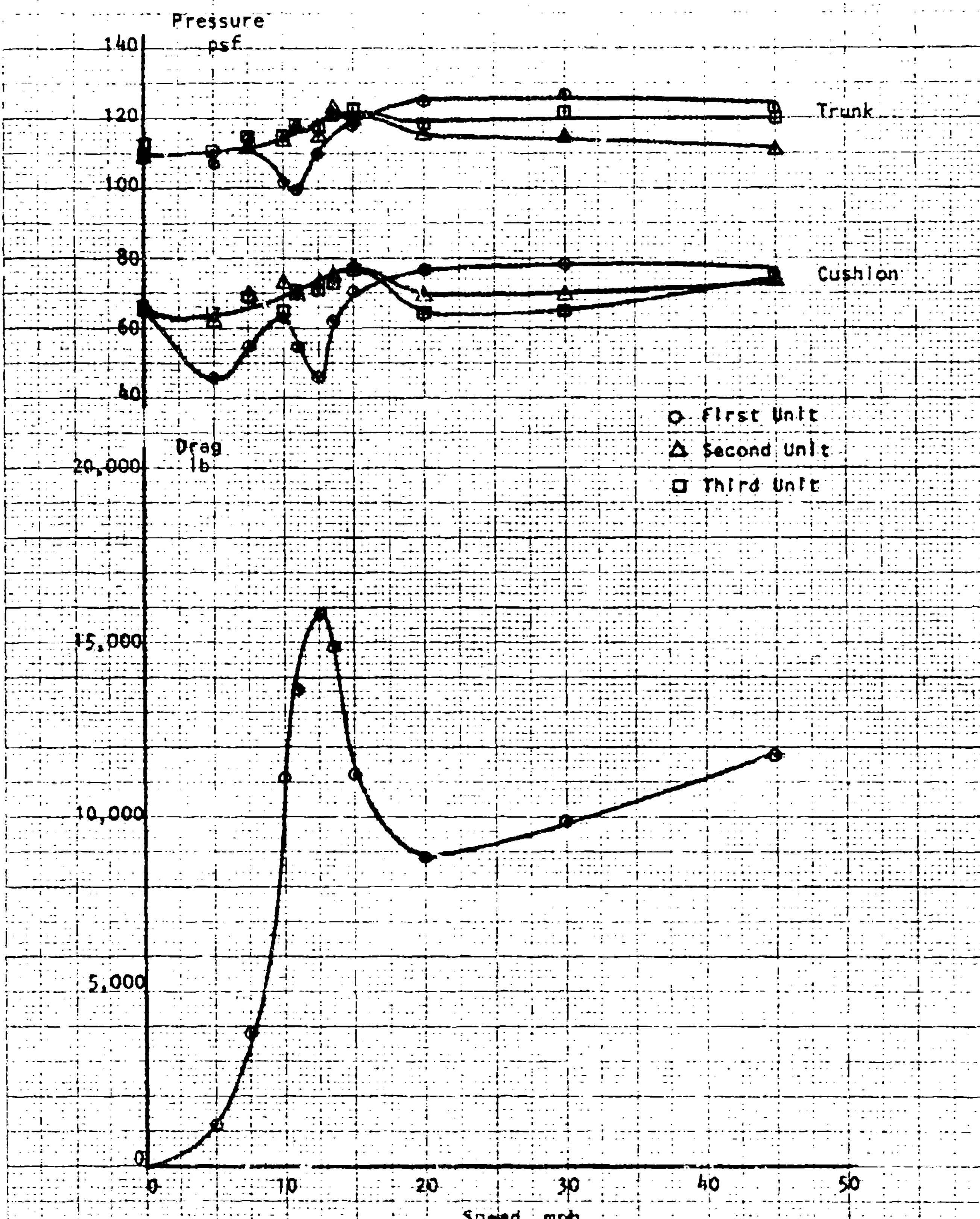
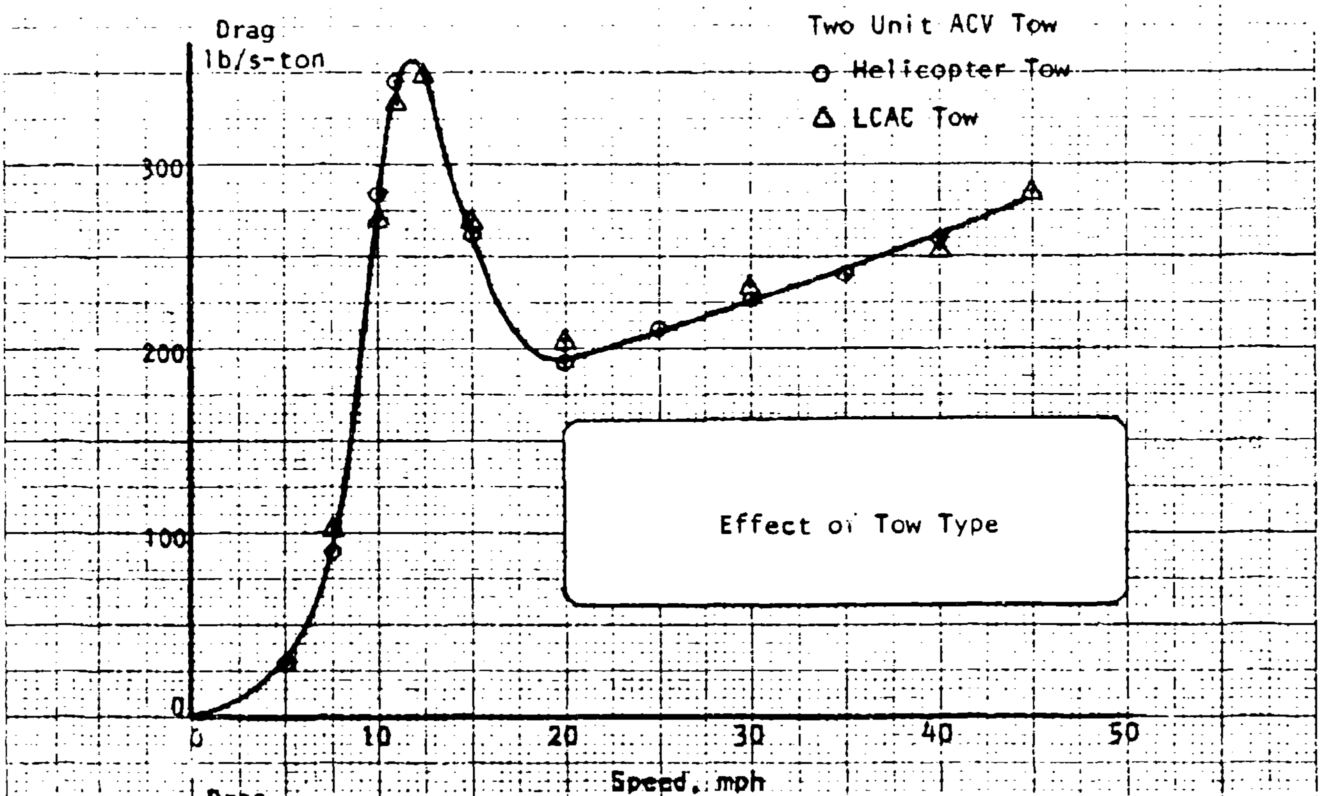


FIGURE 13 THREE UNIT ACV TRAIN IN CALM WATER
LCAC TOW, 22.7 FT SPACING, TRACKS DOWN



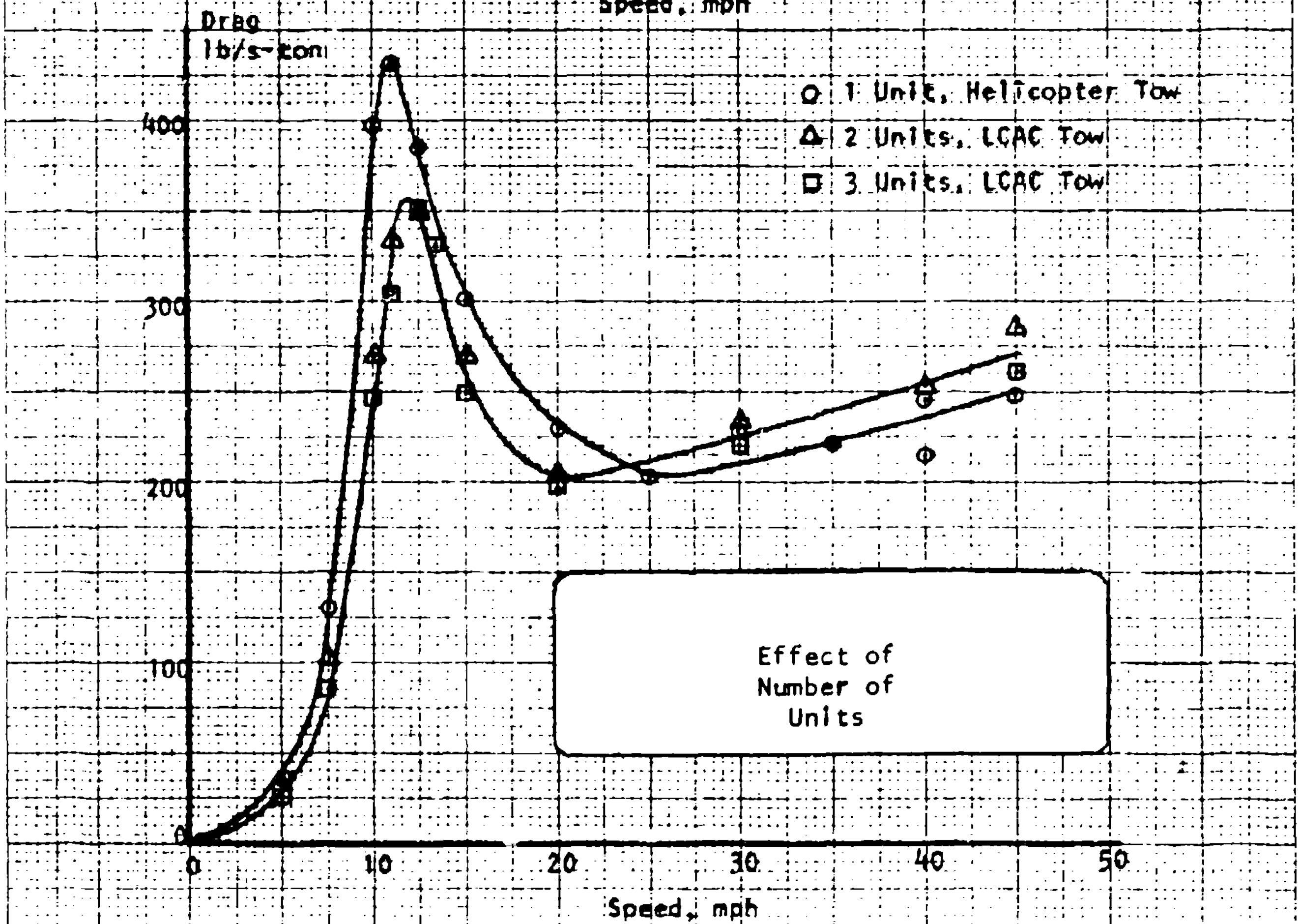
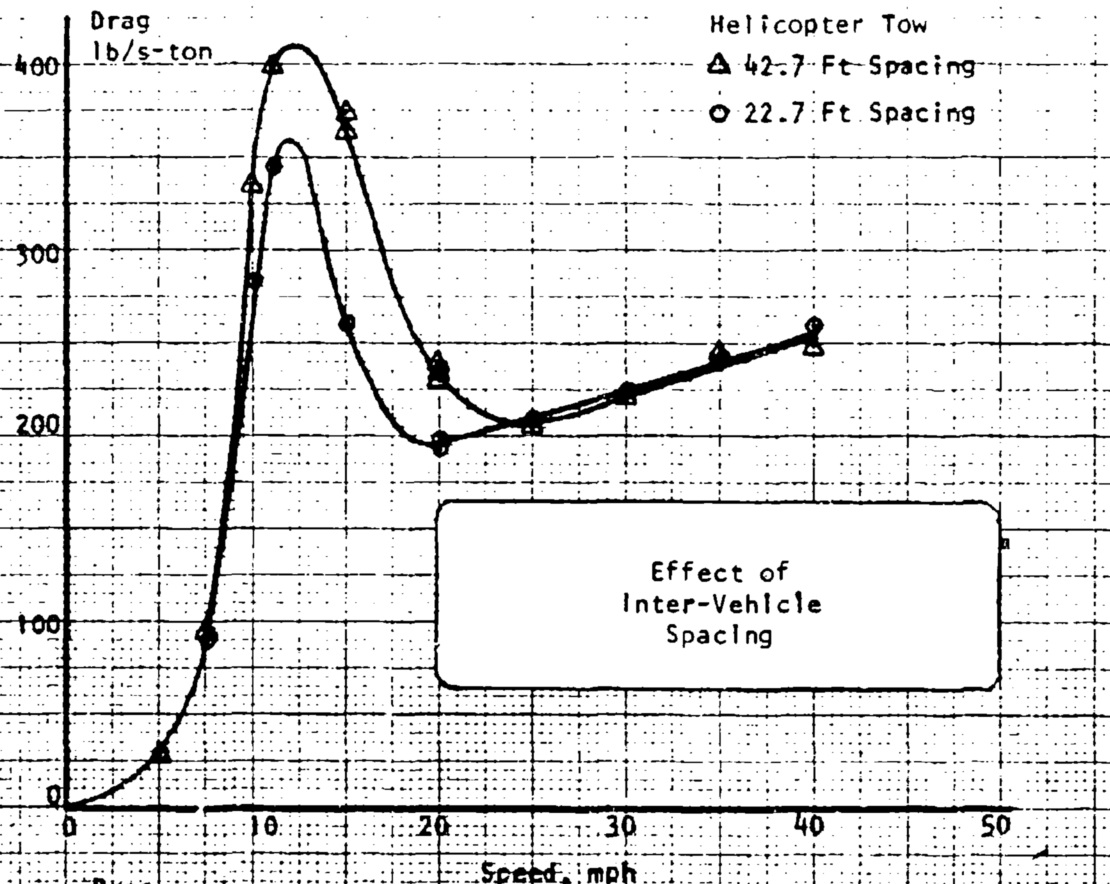


FIGURE 14 CALM WATER DRAG COMPARISON



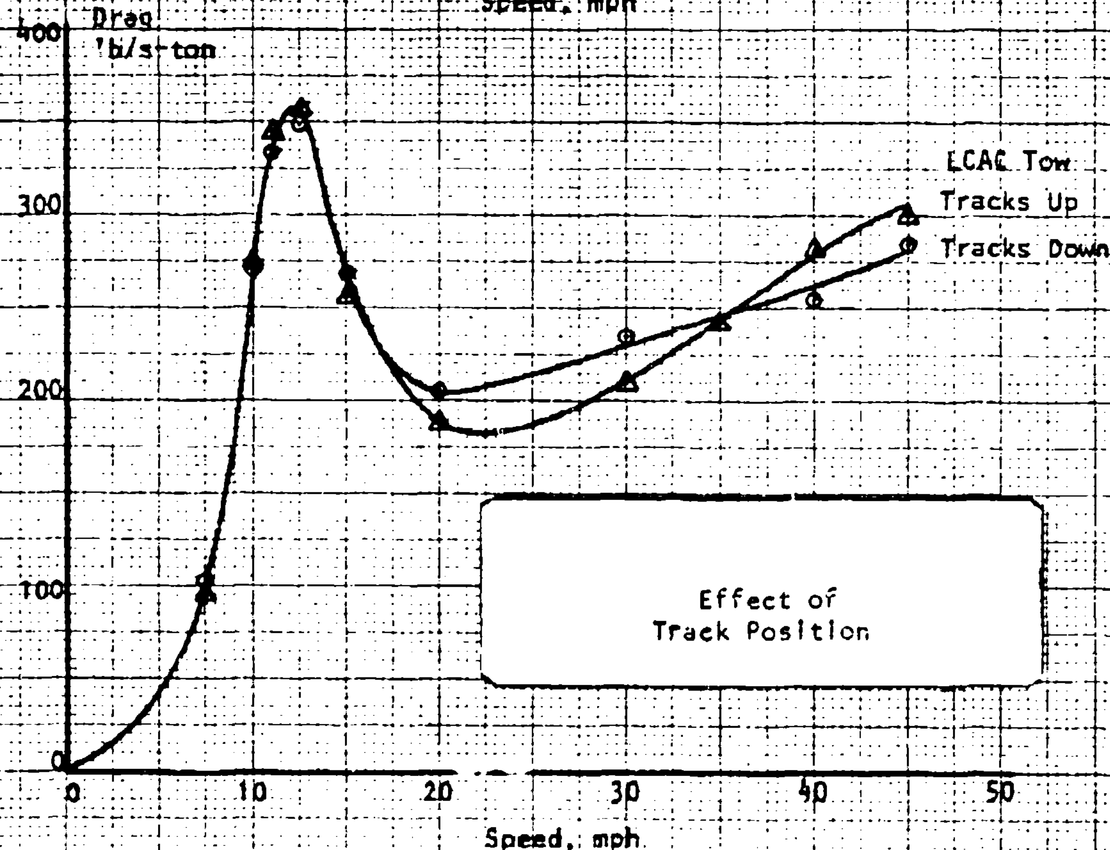


FIGURE 15 CALM WATER DRAG COMPARISON, TWO UNITS

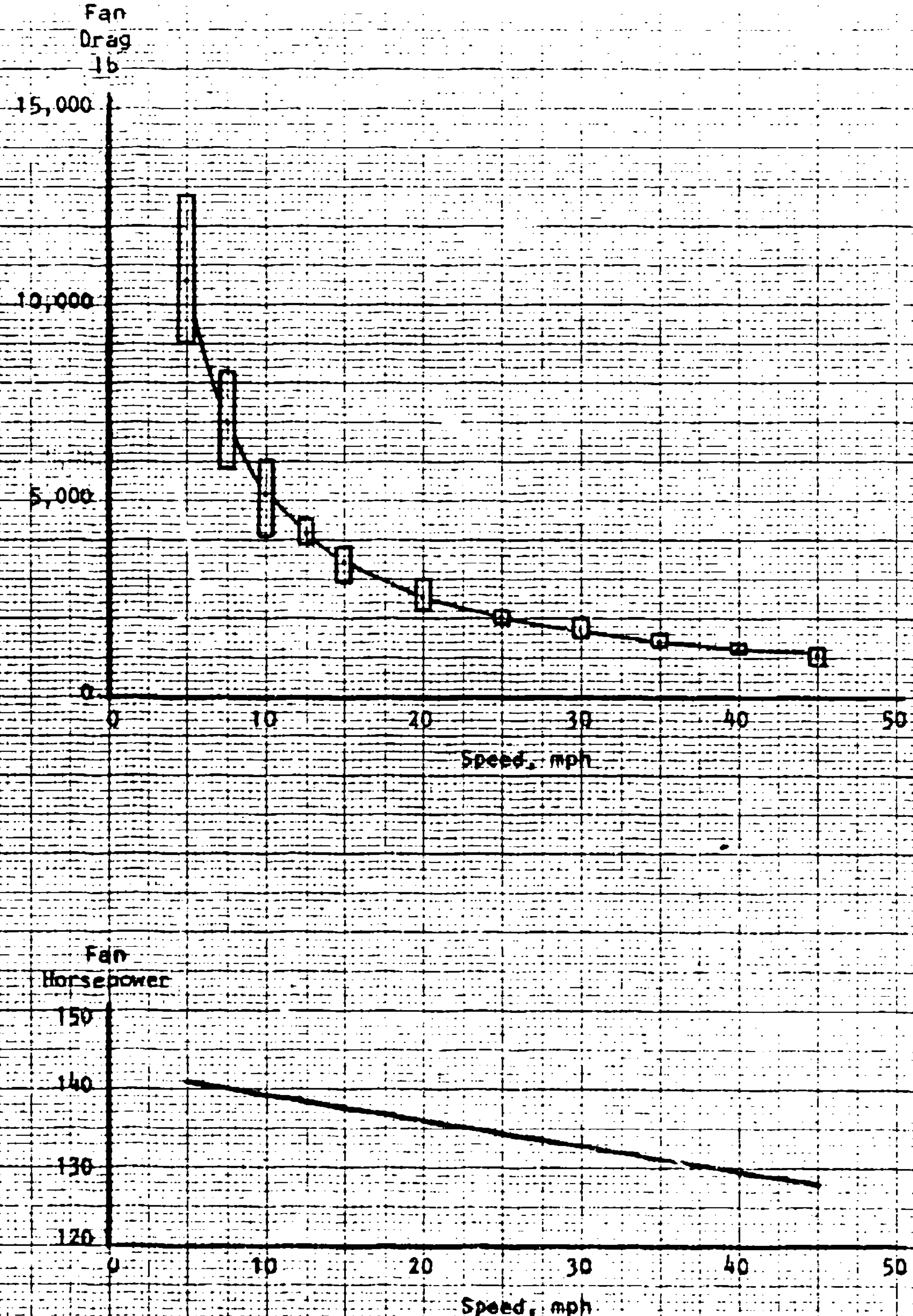


FIGURE 16 AVERAGE FAN DRAG AND FAN HORSEPOWER
OF ALL CALM WATER RESULTS

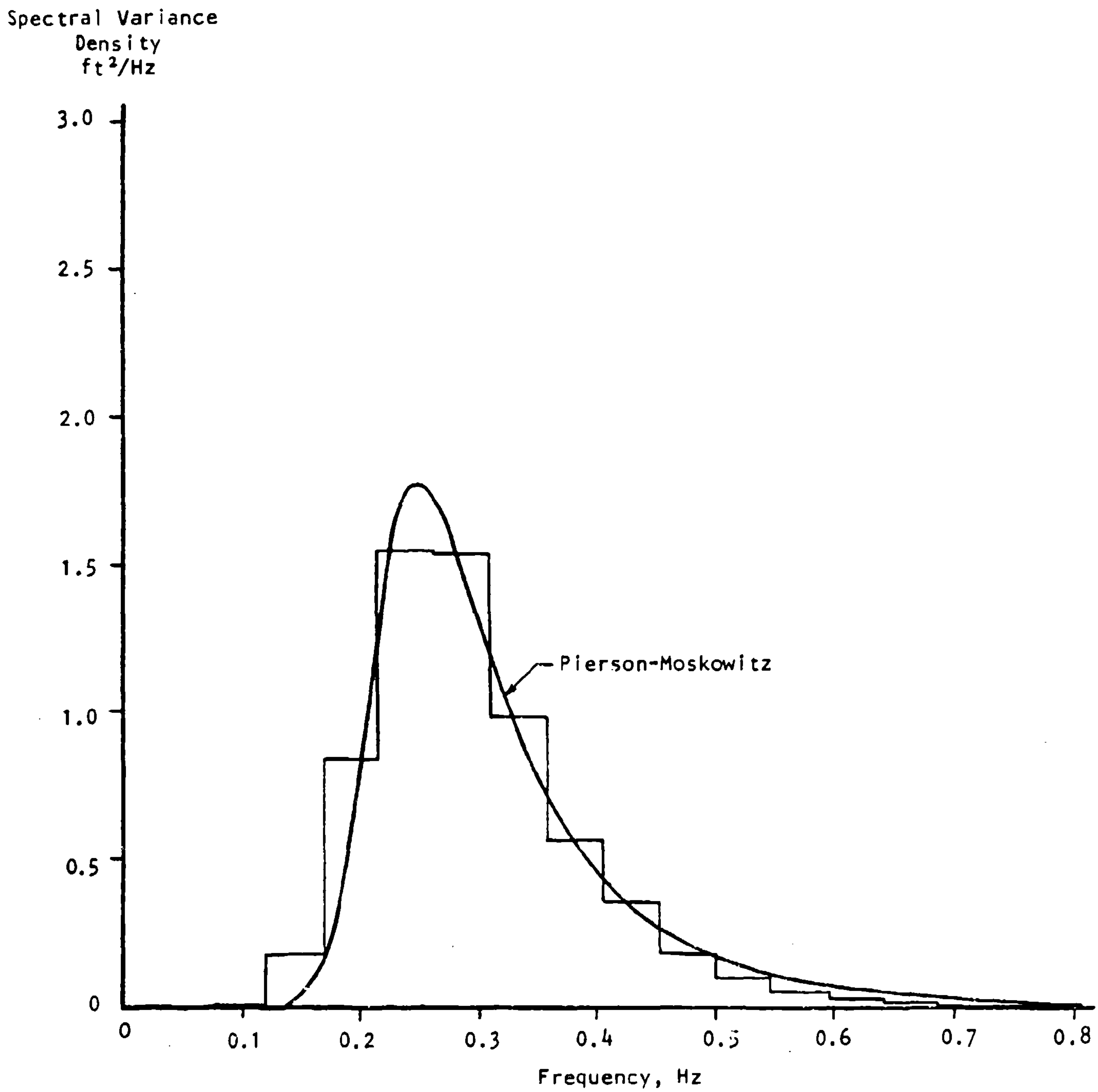
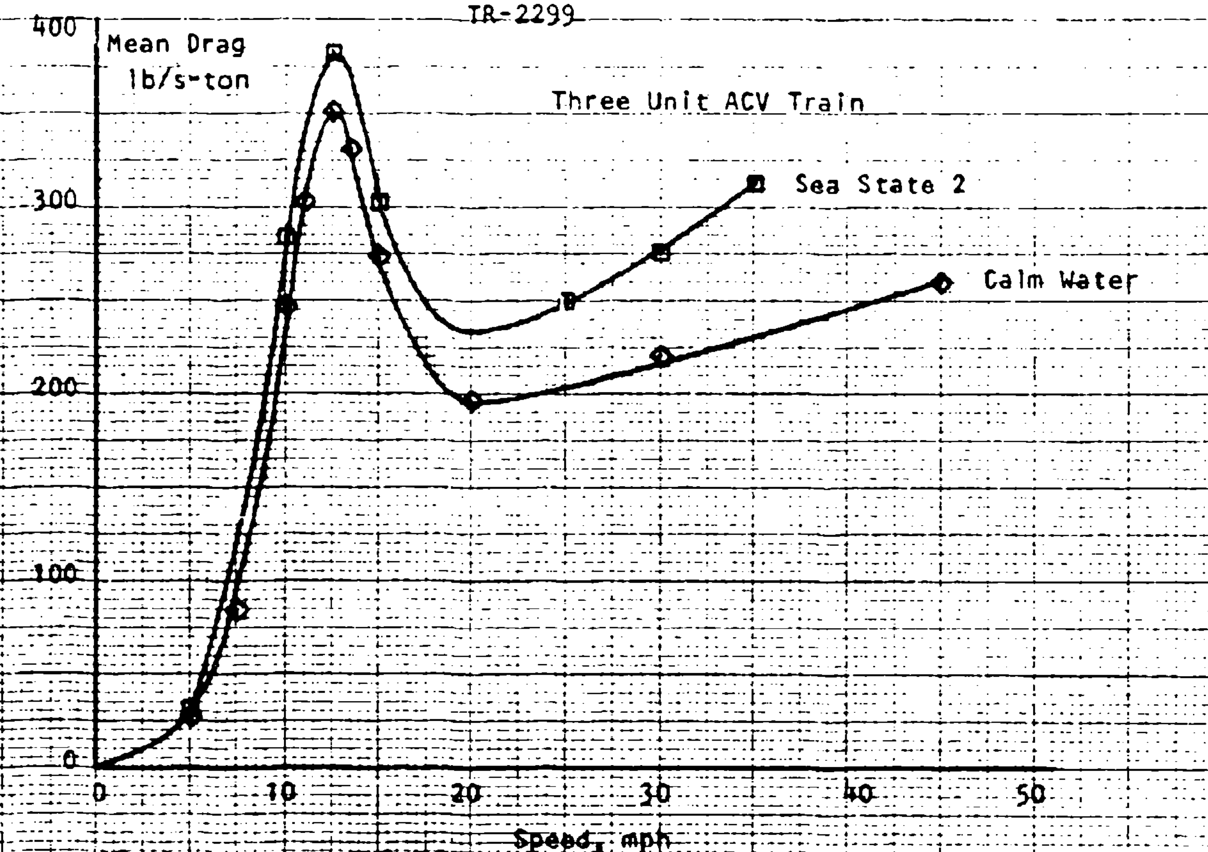


FIGURE 17 EXPERIMENTAL WAVE SPECTRUM
SIGNIFICANT HEIGHT 2.2 FT



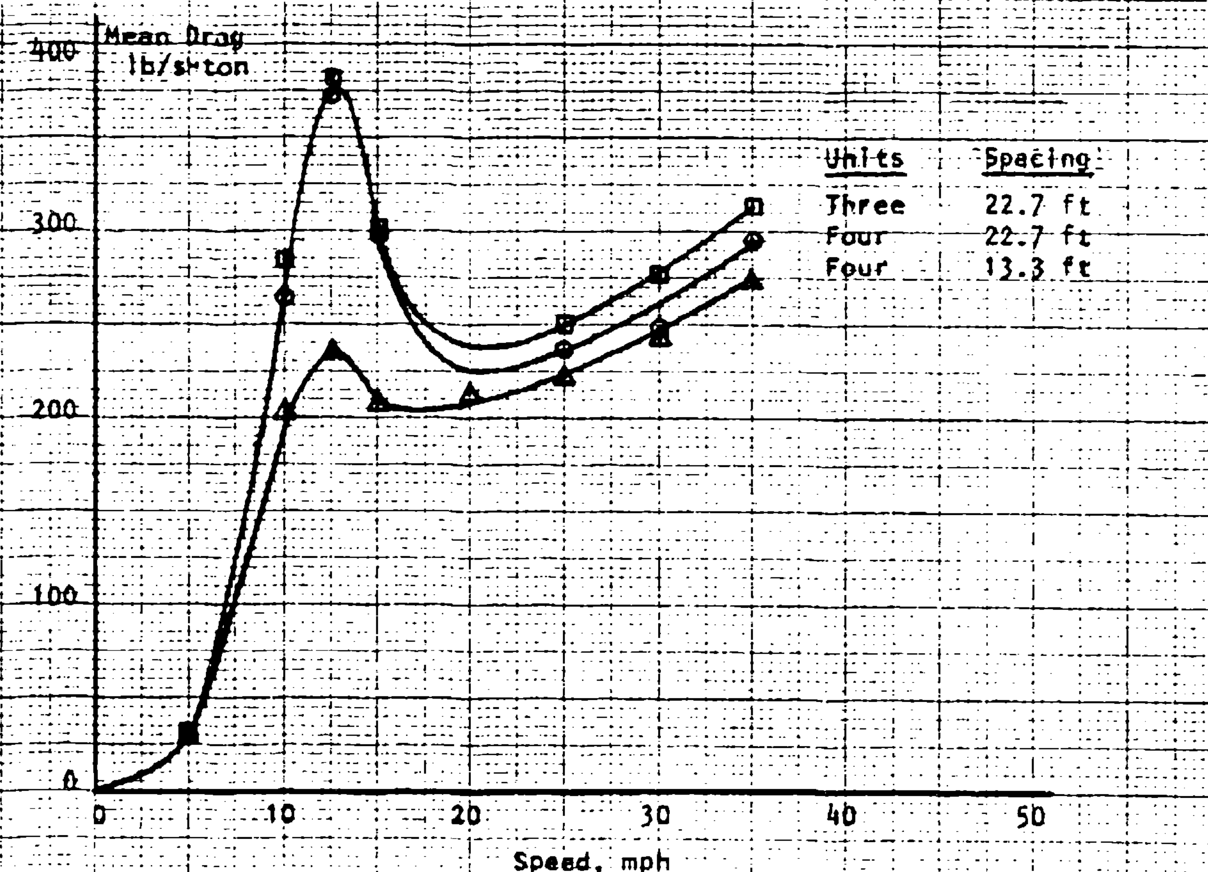


FIGURE 18 MEAN DRAG IN SEA STATE 2

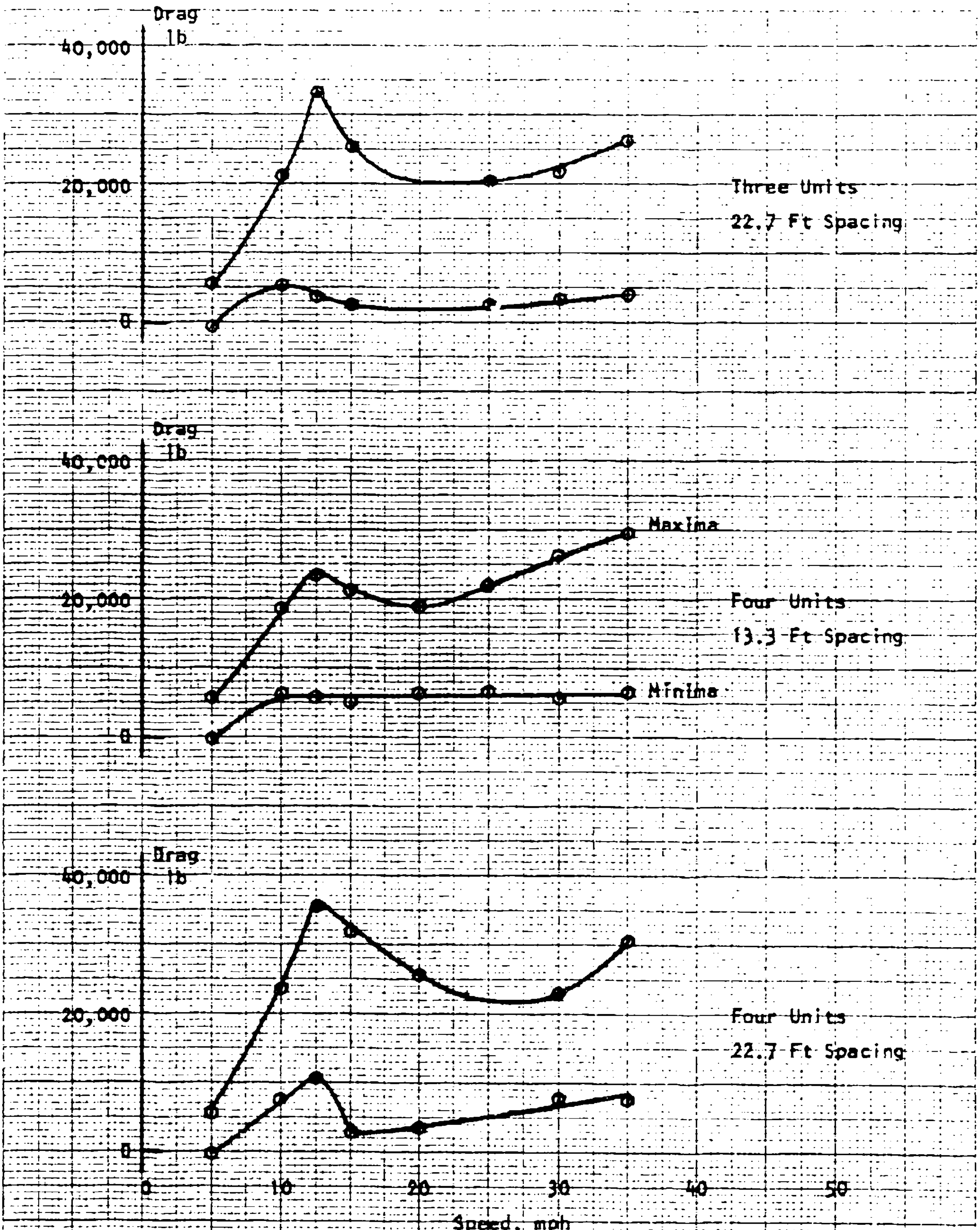


FIGURE 19 SIGNIFICANT DRAG VALUES IN SEA STATE 2

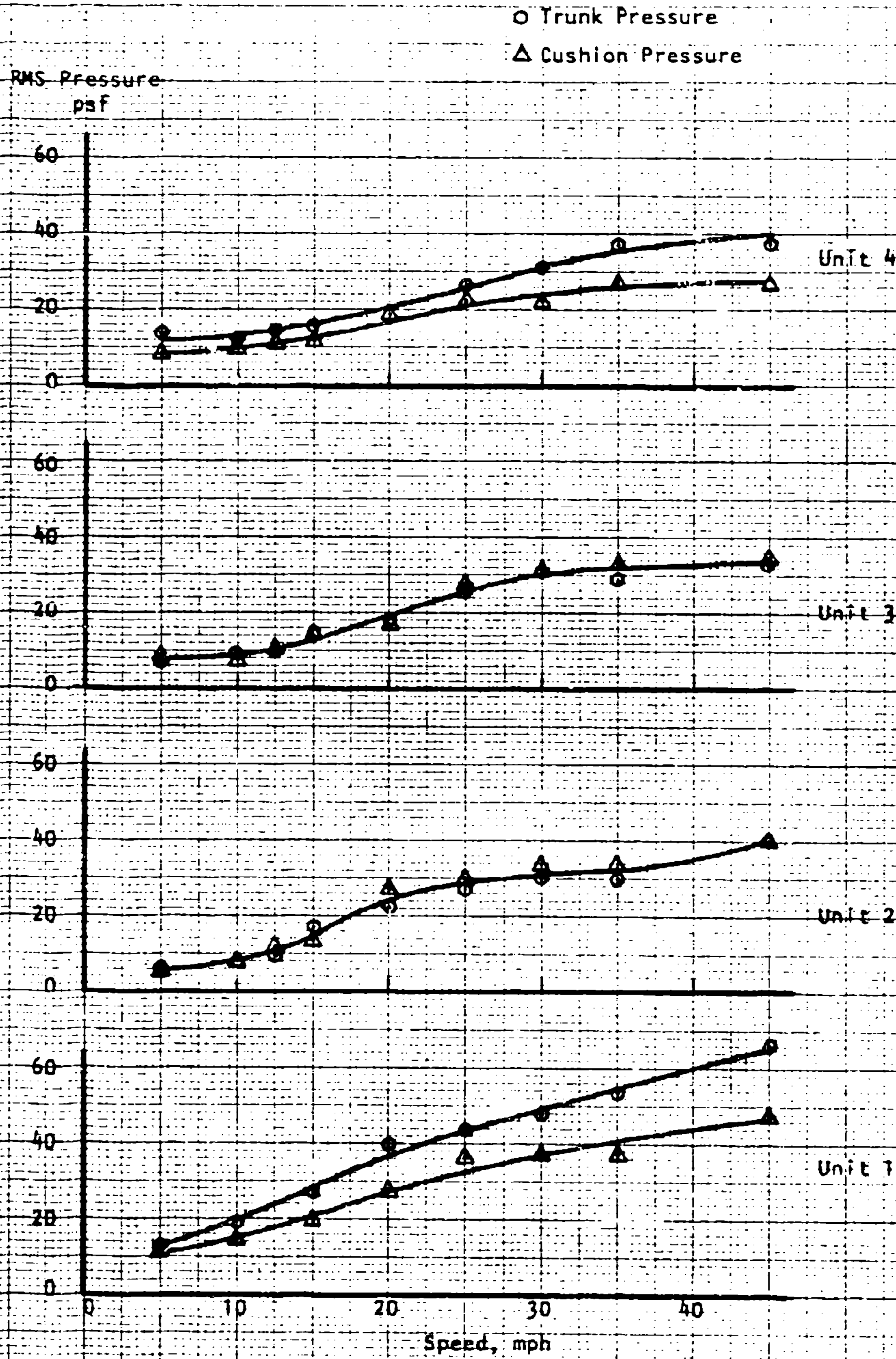


FIGURE 20 RMS PRESSURE VARIATION IN SEA STATE 2
FOUR UNIT TRAIN, 13.3 FT SPACING

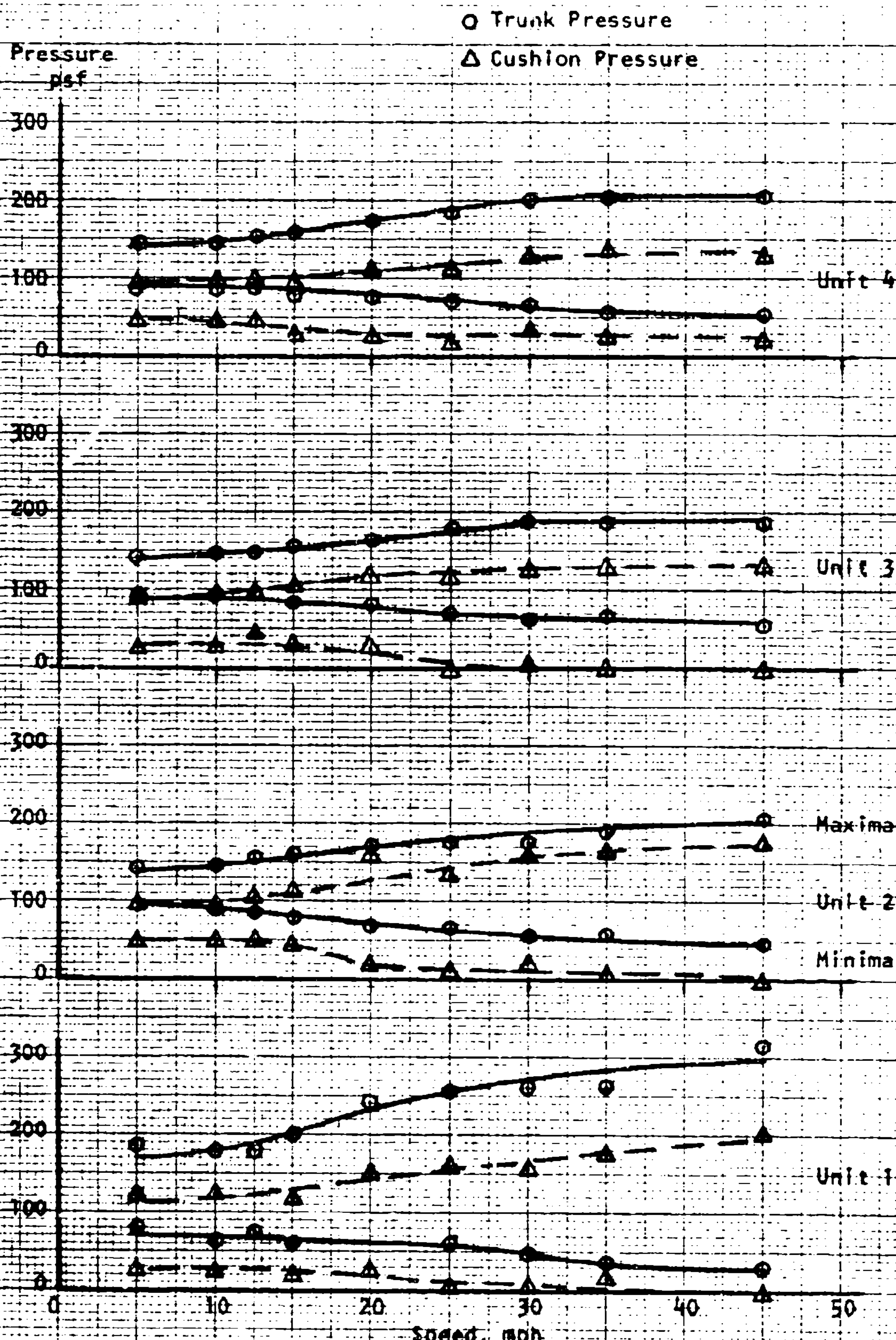


FIGURE 21 SIGNIFICANT PRESSURE VARIATIONS IN SEA STATE 2
FOUR UNIT TRAIN, 13.3 FT SPACING

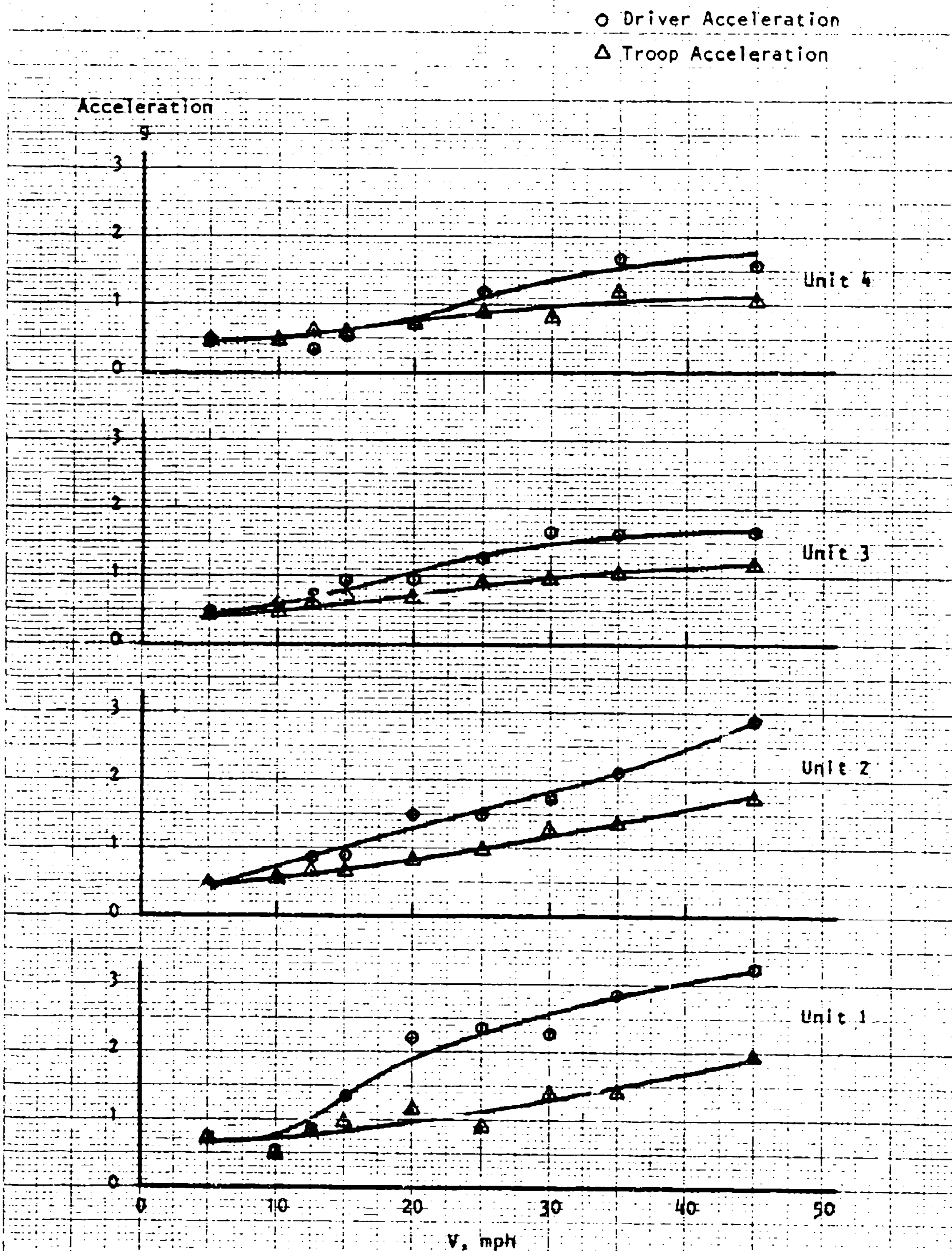


FIGURE 22 SIGNIFICANT VERTICAL ACCELERATIONS IN SEA STATE 2
FOUR UNIT TRAIN, 13.3 FT SPACING

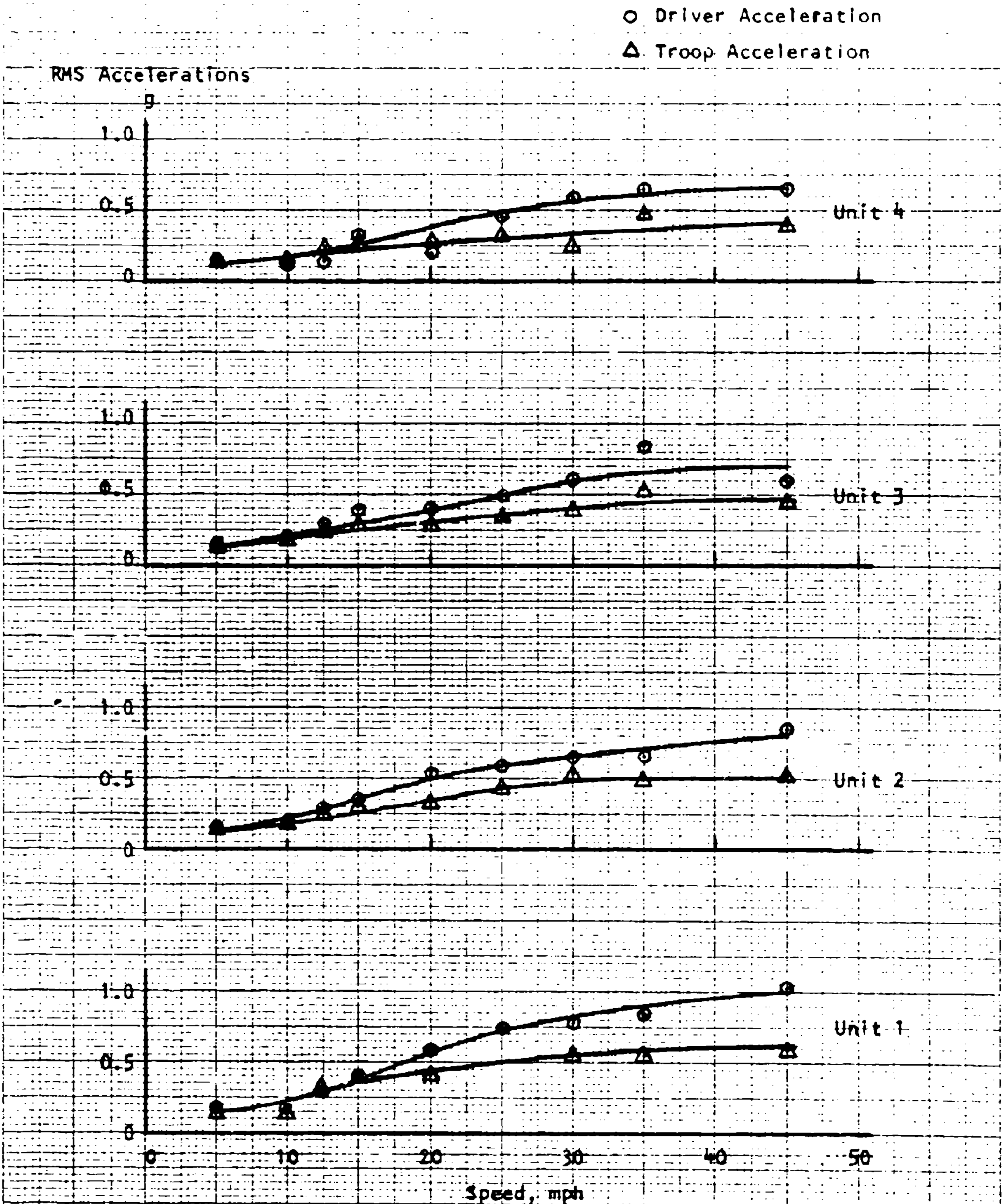


FIGURE 23 RMS VERTICAL ACCELERATIONS IN SEA STATE 2
FOUR UNIT TRAIN, 13.3 FT SPACING

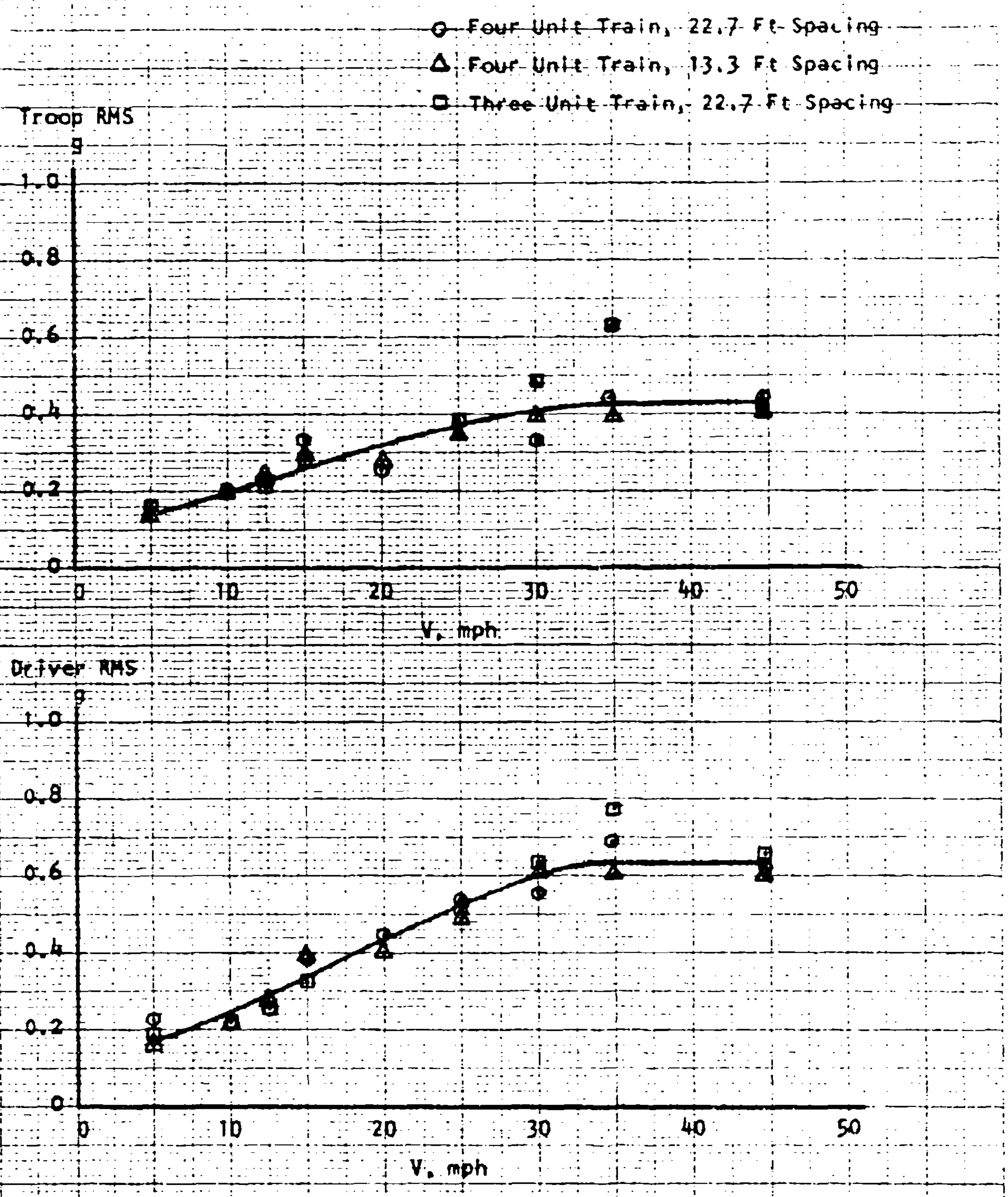


FIGURE 24 RMS VERTICAL ACCELERATIONS IN THE THIRD UNIT
SEA STATE 2

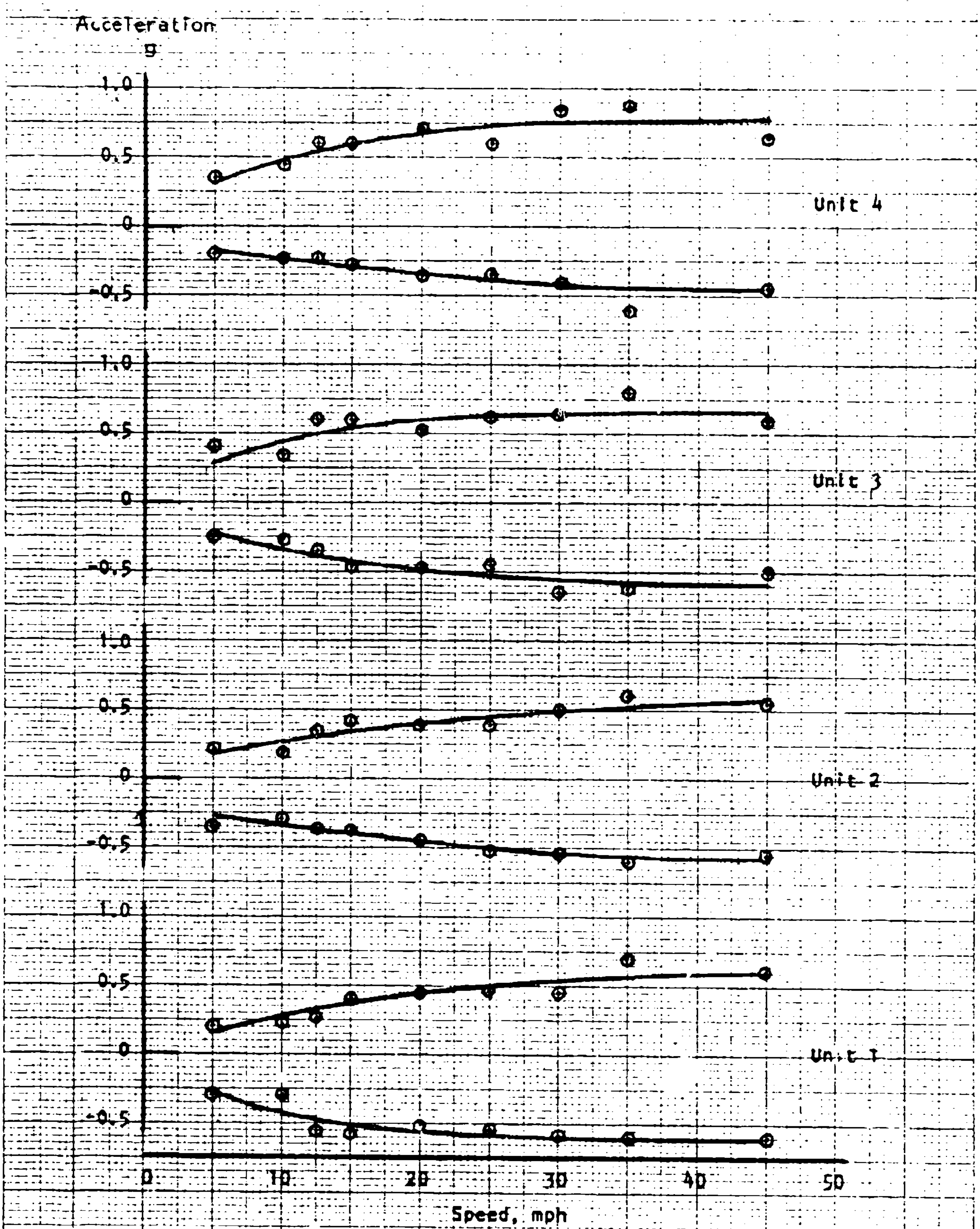


FIGURE 25 SIGNIFICANT HORIZONTAL ACCELERATIONS IN SEA STATE 2
FOUR UNIT TRAIN, 13.3 FT SPACING

APPENDIX
ACV BARGE TRAIN
VIDEO SCENARIO

SEA STATE	NO. OF UNITS	TYPE OF TOW	INTER-VEHICLE SPACING ft	TRACK CONFIGURATION	RUN	SHIP SPEED mph	FOOTAGE
Calm	1	Helicopter	NA	Down	1	5.0	6
					2	5.0	14
					3	10.0	25
					4	15.0	30
					5	20.0	33
					6	25.0	35
					7	30.0	39
					8	35.0	43
					9	40.0	45
					10	40.0	46
					11	45.0	47
					12	7.5	48
					13	12.5	56
					14	11.0	60
					15	40.0	65
Calm	2	Helicopter	22.7	Down	16	5.0	69
					17	10.0	81
					18	10.0	86
					19	15.0	89
					20	15.0	94
					21	20.0	97
					22	20.0	103
					23	25.0	105
					24	30.0	107
					25	35.0	109
					26	40.0	111

APPENDIX

VIDEO SCENARIO

(Continued)

SEA STATE	NO. OF UNITS	TYPE OF TOW	INTER-VEHICLE SPACING ft	TRACK CONFIGURATION	RUN	SHIP SPEED mph	FOOTAGE
Calm	2	Helicopter	22.7	Down	27	40.0	112
					28	45.0	113
					29	7.5	117
					30	7.5	120
					31	11.0	125
Calm	2	Helicopter	42.7	Down	32	5.0	128
					33	7.5	136
					34	10.0	141
					35	11.0	143
					36	15.0	148
					37	20.0	155
					38	25.0	160
					40	15.0	161
					41	20.0	164
					42	20.0	166
					43	25.0	169
					44	30.0	172
					45	35.0	175
					46	40.0	179
					47	45.0	180
Calm	2	LCAC	22.7	Down	49	7.5	182
					50	10.0	195
					51	11.0	197
					52	12.5	200
					53	15.0	204

APPENDIX

VIDEO SCENARIO

(Continued)

SEA STATE	NO. OF UNITS	TYPE OF TOW	INTER-VEHICLE SPACING ft	TRACK CONFIGURATION	RUN	SHIP SPEED mph	FOOTAGE
Calm	2	LCAC	22.7	Down	54	20.0	209
					55	30.0	212
					56	45.0	215
					57	40.0	217
Calm	3	LCAC	22.7	Down	59	5.0	219
					60	7.5	228
					61	10.0	233
					62	12.5	238
					64	15.0	241
					65	20.0	247
					66	30.0	249
					67	45.0	251
					69	11.0	252
					70	13.5	256
Calm	2	LCAC	22.7	Retracted	72	7.5	259
					73	10.0	265
					74	11.0	269
					75	12.5	273
					76	15.0	276
					77	20.0	279
					78	30.0	281
					79	45.0	283
					80	40.0	288
					81	35.0	291

APPENDIX
VIDEO SCENARIO
(Continued)

SEA STATE	NO. OF UNITS	TYPE OF TOW	INTER-VEHICLE SPACING ft	TRACK CONFIGURATION	RUN	SHIP SPEED mph	FOOTAGE
2	3	LCAC	22.7	Down	86	5.0	304
					87	10.0	312
					88	12.5	317
					89	15.0	320
					90	20.0	323
					92	30.0	325
					93	45.0	328
2	4	LCAC	22.7	Down	95	12.5	338
					96	10.0	342
					98	10.0	348
					99	12.5	353
					100	15.0	356
					101	20.0	360
					102	30.0	363
					103	45.0	364
					105	25.0	367
					106	35.0	369
					107	45.0	371
					108	20.0	374
					109	30.0	377
					110	45.0	379
					111	35.0	381
2	3	LCAC	22.7	Down	112	10.0	383
					113	12.5	389
					114	15.0	393

APPENDIX

VIDEO SCENARIO

(Continued)

SEA STATE	NO. OF UNITS	TYPE OF TOW	INTER-VEHICLE SPACING ft	TRACK CONFIGURATION	RUN	SHIP SPEED mph	FOOTAGE
2	3	LCAC	22.7	Down	115	20.0	397
					116	30.0	400
					117	25.0	402
					118	25.0	404
					119	35.0	406
					120	35.0	408
					121	45.0	409
2	4	LCAC	13.3	Down	123	5.0	412
					124	10.0	417
					125	12.5	422
					126	15.0	426
					127	20.0	429
					128	20.0	432
					129	30.0	434
					130	30.0	438
					131	30.0	439
					132	45.0	441
					133	45.0	443
					134	35.0	444
					135	35.0	446
					136	25.0	448
					137	25.0	449